CALIFORNIA ENERGY RESOURCES CONSERVATION

AND DEVELOPMENT COMMISSION

STAFF WORKSHOP

2005 BUILDING ENERGY EFFICIENCY STANDARDS

TIME DEPENDENT VALUATION AND COST

EFFECTIVENESS METHODOLOGIES

HEARING ROOM A
CALIFORNIA ENERGY COMMISSION
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10:00 a.m.

Reported By:

Peter Petty

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COMMISSIONERS PRESENT

Arthur H. Rosenfeld

Robert Pernell

STAFF PRESENT

Byron Alcorn

Bill Pennington

Bruce Maeda

TEAM CONSULTANTS

Gary Fernstrom, PG&E

Douglas Mahone
Jon McHugh
Heschong Mahone Group

Snuller Price, E3

Bruce Wilcox, BSG

Charles Eley, Eley Associates

Ken Nittler, EnerComp

ALSO PRESENT

Robert Raymer, CBIA

Robert Weatherwax, SERA

Lance DeLaura, SoCalGas

A.Y. Ahmed, Occidental Analytical Group

Rob Hammon, ConSol

Steve Gates, Hirsch & Associates

Bill Mattinson, Sol Data

Katie Coughlin, Lawrence Berkeley Lab

Dave Ware, Owens Corning

APPEARANCES

ALSO PRESENT (continued)

Peter Schwartz

John Hogan, City of Seattle

Daryl Hosler, SoCalGas

Mark Lindberg, FAFCO, Inc.

I N D E X

P R O C E E D I N G S

MR. ALCORN: Thanks very much, everyone, for coming today.

My name is Bryan Alcorn. I'm the Contract Manager for this round of the Building Standards. And to my right is Bill Pennington. Bill Pennington is the technical lead for this round of the standards. And to his right is Charles Eley, who's the prime contractor for this work.

I would like to welcome Commissioner Rosenfeld to the workshop today. Hopefully Commissioner Pernell will be joining us at some point.

(Laughter.)

COMMISSIONER PERNELL: Speak of the devil.

MR. ALCORN: All right. Well, welcome, Commissioner Pernell.

COMMISSIONER PERNELL: Thank you.

MR. ALCORN: You're welcome.

I just want to take a minute to talk about the purpose of the workshop this morning, or today. We're going to be discussing the topic of Time Dependent Valuation, the methodology specifically, that's proposed to replace the current source energy method. The workshop is going to focus on the fundamentals of the methodology, and there will be an initial analysis of the implications that its use may have on compliance with the standards for different efficiency measures and energy sources.

We'll also discuss the cost effectiveness approaches planned to evaluate the measures under consideration for the standards. And, finally, there will be a discussion about changes to improve the accuracy of the building energy efficiency modeling, particularly related to TDV.

I want to talk about a couple of housekeeping items, and then Bill Pennington has a few comments to make.

First of all, there's a sign-in sheet which hopefully most of you have already signed in to, or stapled a business card to. If you haven't done that, please do that. Also, if you're going to make comments today, if you could please provide the recorder, who is sitting across the table there, thank you, with your business card, that would be most helpful, so that the spelling of your name could be correct in the final transcribed documents.

Also, when you're speaking, if before you make your comments you could announce yourself for the recorder, that would also be great.

Finally, if you're not sitting at a microphone at the table, if you do have comments, if you could please approach the lectern, say your name, and then make your comments.

At that point, I want to ask if there are any comments by either of the Commissioners. Commissioner Pernell?

COMMISSIONER PERNELL: Thank you. I think you've covered everything sufficiently. I just want to welcome everyone to the Commission, to this workshop, and just so that you know, this is not anything that we are doing. It takes us collectively to come up with the outcome.

So, welcome. This might be -- we can either get it done in an hour, or six hours. But it doesn't matter, we'll be here until we're done. So please feel free to step up to the mic, give us your opinion, because that's why we're here.

Thank you.

COMMISSIONER ROSENFELD: I want to

welcome you all, too. I think that Time Dependent Valuation is certainly an idea whose time has come. I'm not quite clear why we didn't think about this 15 years ago, but --

COMMISSIONER PERNELL: You weren't here, that's why.

COMMISSIONER ROSENFELD: I'm pretty sure it's going to sweep the country. After all, what we are trying to do here is to give us all the energy services we want at the least cost, and I never really have understood this idea that energy, per se, is anything totally. There's lots of energy, it's just expensive. If it's used, as in solar, or it's running out like in oil, or it's dirty, like in coal.

And so it's really cost we're trying to minimize, and then, obviously, we are ought to look at electricity, cost and time of day. So, let's go.

MR. ALCORN: Thank you.

You were mentioning 15 years ago. It's, I don't know if I should take offense at that or not.

COMMISSIONER ROSENFELD: Go ahead.

(Laughter.)

MR. PENNINGTON: Actually, the idea of switching from source energy use to some sort of a dollar based approach was first recommended about 15 years ago, as I recall, with the ASHRAE standards using a dollar based approach. That was a comment, and there was a fair amount of discussion at that point. I remember debating this issue with Charles at a conference about that long ago.

Since that time, PG&E actually proposed that we go to a time of use basis in the 1995 Standards. And that proceeding was, you know, a very minimal proceeding, basically a clean-up proceeding, so we couldn't get to it then. In 1998 they raised it again; at that point we really weren't looking at a major scope change for the standards, and so we turned them down again in 1998.

After the 1998 Standards, the Energy Commission and PG&E jointly funded some contract work to do the developmental work of what we might have to do to convert over to a time of use basis. And that was the original work that this further work that PG&E has done grew out of. In AB 970, PG&E suggested it again, and, of course, on the emergency timeframe that we were on at that point, we couldn't accommodate it.

But in the contractual work that we did after the 1998 standards, our goal was to develop this to the point that it could be considered for the 2005 standards. And so, you know, we're basically implementing that goal.

The Staff has worked considerably with PG&E and its contractors, and the gas company, as well, in talking about these issues and trying to develop a TDV proposal that would be effective. A fair amount of the work that's been done by PG&E relies on Energy Commission forecasts, to the extent that those address the issues that we're trying to address here. And at this point, the Building Standards Staff at the Commission support the economic forecasting that's being recommended by PG&E and the HVAC and duct modeling changes that are being recommended.

MR. ALCORN: Okay. Thank you, Bill.

The first speaker today is Gary Fernstrom, from PG&E, who will be introducing the topic of Time Dependent Valuation.

MR. FERNSTROM: Thank you, Brian. I'm Gary Fernstrom, from the Pacific Gas and Electric

Company.

Commissioners, Staff, and interested parties, it's our pleasure to finally be here and bring this proposal to you. Bill did such a nice job of covering the history, I don't think I'm going to need to do that too well, or too much further, other than to maybe talk about what some of the specific deliverables are that we have generated so far. So if we could have the next slide, please.

And the first bullet on that slide, PG&E proposed the notion of Dollar Based Performance Standards, as Bill said, in 1998. There was some work prior to that. If we could have the next slide.

In 1999 through 2001, Southern California Edison and Southern California Gas Company joined the project team in terms of providing support, review and financial contribution, as well. So the products developed so far have been a TDV cookbook that outlines the economic methodology, an engineering model, and enhancements that allow TDV to actually be calculated for compliance purposes. We've done some demonstrations of compliance outcomes, and we're here to present a complete proposal to the CEC at this time.

Next slide, please.

So the project team consists of the CEC Staff, who has been an advisor and participant in the first study phase of the work. PG&E has been the development lead. As I noted, Southern California Edison and SoCalGas have provided support, financial support, review and advice.

The consultant team is led by the Heschong Mahone Group, coupled with E3, and Eley and Berkeley Solar Group, have provided engineering support. There are other stakeholders that have contributed in terms of providing advice to the effort so far. That's the California Building Industries Association, Natural Resources Defense Council, and a few others that we have consulted in the process.

So here we are, at the first public workshop, and I'd like to turn the presentation over to Doug Mahone, of HMG.

MR. MAHONE: Thanks, Gary. I'll talk from up here, I guess, so I can see everybody a little more clearly.

There are copies of the slide handout

out on the front table. If any of you didn't get them, you might find it easier to follow along. I realize that having six slides to a page is a little bit challenging for those of us who are having a harder and harder time seeing small print, but we've tried to make it as readable as possible.

Also, there is another document out there, the Code Change Proposal presented by PG&E, which has way more detail in it about all of this than we're going to have time to talk about today. But I would recommend you get a copy of it if you have any interest in it. The latter, probably third of this document, is what we call the TDV cookbook, which goes into some detail on the economics methodology and all the sources of the data and all the manipulations of the data that are used to develop the TDV values.

Next slide, please.

So this issues map that I have up here is kind of a simple graphic version of the main topics that we're going to be covering today.

The first one here is the TDV economics, which is the development of the methodology for assigning economic values to energy savings. And this is really the foundation of the entire TDV approach. And as you'll see when we get to the end of the presentation, it manifests itself within the Title 24 standards as a change in definition. We're basically going to be tearing out the old definition for source energy, and replacing it with the new definition for what we're calling Time Dependent Valuation Energy, or TDV Energy.

Then the other three yellow boxes there are engineering enhancements to the way that the computer methods for calculating energy use in buildings under Title 24 are implemented. We call these ACM changes. ACM is the Energy Commission's term for Alternative Calculation Methods. And there are a number of changes in the details for how the computer methods simulate the energy use in the standard building and in the proposed building, and how we essentially enhance those calculations so that they can do an hour by hour calculation of savings of all the different measures in the building. And, of course, having an hourly estimation of savings is important because TDV assigns an hourly savings value, as I'll be talking about in a minute.

So within these ACM changes, we have a series of residential modeling changes and a series of non-residential modeling changes, and we've distinguished those because we use different analysis tools and different rule sets for dealing with residential and non-residential buildings.

The gray box on the bottom is kind of a catch-all for all of the other engineering enhancements that may or may not become necessary to adopt. We're embarking upon a whole series of workshops over the next couple of months to -- for the Commission to review all of the different code change proposals that people are bringing forward, and depending on which of those changes are adopted, there may need to be additional adjustments to the engineering methodology so that they can work with the hourly TDV approach.

So, next slide, please.

So we'll start with the big picture, then, about what were the goals for TDV and why did we embark upon this development process. The fundamental goal is that we want a population of buildings within California that have lower peak demands than the current population does. And we're talking a lot of buildings here. We're talking about over 100,000 homes that are built every year, and several thousand non-residential buildings that are built every year. And these buildings, as we know from the peak crises that we have, are a big part of the reliability problems that we've had in California, and they're a big part of the peak costs for energy and how those are reflected in the cost of the electricity system.

So if we can encourage the designers of all these buildings that are going to be coming online over the next 10, 15, 20 years to design them in a way that lowers their peak demands, we will lower the overall costs for the entire electricity system in California, it'll give us some insurance against future blackouts -- of course, there's other things that you can screw up that'll still lead to blackouts, like not building any power plants -- but at least we can do our part here in the Building Standards to achieve a long-term demand reduction.

And doing this within the building stock at the time the buildings are new, when they are first being designed, is the cheapest way to do that. The cheapest way to change the peak characteristics of a building is when it's still on the drawing board. It's very easy to make changes, it's inexpensive to adjust the design of the building. A lot of the things that make the building less peaky, in terms of its energy use, are very low cost or no cost, but trying to go back and retrofit them, or trying to go back and reduce building peak energy loads after the building is built and in operation is much more expensive.

So those are kind of the broad goals. Let's go to the next slide.

We also have some goals for the compliance process, because, of course, just writing an energy code doesn't save the energy; you actually have to make it work in the way the buildings are designed, and that's the whole compliance process. People have to understand what the compliance process is so that they can build the buildings, following the signals that we're trying to give them. And, of course, you have to be able to enforce it.

So there is a considerable body of knowledge and expertise around the State of California for people who know how to meet the current requirements of Title 24. And we don't want to just throw them a completely new ballgame with this whole TDV approach. So we thought a lot about how to change Title 24 so that you can still have easy compliance, so people can still understand how to do what we're asking them to do.

Well, the first change to the compliance process is to throw out the old flat rate energy basis for savings. And that's kind of a technical change which -- next bullet, please -- which can be done in a way that's fundamentally transparent to the end user, the person who's trying to comply with the code.

The effect of what you get when you adopt TDV instead of the flat energy basis is that when a designer or a builder is looking at their building design and considering the various measures that they can do, trying to figure out what's most cost effective for their point of view, what meets their particular needs for their building, they'll be looking at trade-offs. And that's an old venerable process in California, giving designers the flexibility of doing trade-offs.

Well, what happens under TDV is that

some measures are given more credit than other measures, compared to the way it's currently done now. So measures in the building design that reduce the on peak energy use get more credit for those savings than measures that achieve their savings in off peak periods. And I've got a whole presentation later on in the day to demonstrate how that works. But in a nutshell, that's what it does.

So, next slide. So what this does is it gives better signals to designers on how to make the choices in the design of their building in a way that will end up reducing the peak of their particular building and then, of course, as that ripples out throughout the state we'll end up with a population of buildings that have lower peaks.

Now, an important part of this methodology is that when the builders are performing these trade-offs they're using a computer analysis method, and one of the drivers of that computer analysis method is the weather tapes. California has 16 different climate zones, there's 16 different weather tapes, and the buildings that they're modeling are not actually being modeled under, you know, this year's weather conditions. They're modeled using the weather conditions from these weather tapes, which are kind of the long-term average conditions.

So the methodology that we developed had to work within that realm. So the TDV values that are used are tied to the weather tapes, and they're tied to the way the ACMs that the computer methods do their performance calculations. So that's another important part of making this whole concept work within a compliance setting.

So there are number of policy choices involved in doing TDV. We've been studying this now for over three years, and the members of our team have spent a lot of time debating amongst theirselves what kinds of features should be implemented within the TDV method. And a lot of these really boil down to policy choices. And we think there's good reasons for the policy choices that we've recommended here, but, you know, there can be honest questions or honest disagreements about some of those choices. So we wanted to be very up front about what those choices were so everybody understands them.

The first policy choice is to abandon the current regime, which is source energy valuation, and under source energy valuation every hour of the year, the value of savings is the same. And we want to replace that, as I've said, with a time dependent valuation scheme, which is where this terminology, TDV, came from.

So by adopting TDV we're changing a built-in fundamental assumption of Title 24 that's been there since basically Day One. Throwing out the source energy concept and replacing with a time dependent valuation concept.

Now, the source energy concept was based on the notion that you can calculate energy use for any fuels, and it was primarily natural gas and electricity. You calculate the energy use in Btus, and then you convert that into source energy. And for natural gas, that is one of the fundamental sources, so there was no multiplier there. But there was a multiplier applied to electricity use, a source energy multiplier of three. And there's a whole history behind where the number three came from, but in a nutshell, it was a way to account for the inefficiencies of the power plant and the inefficiencies of the transmission and distribution system. So by the time the equivalent of a Btu of electrical energy arrived at a building site, you'd actually consumed about three times that amount of energy at the source to generate and transmit it.

Now, that's a fairly realistic version of what goes on in the world with the electricity system. But with the TDV energy, we're using actual forecasts of costs for electricity and for natural gas, rather than picking this sort of arbitrary factor of three, which was historically done with the source energy concept.

So there's still a basically evaluation differential between electricity, natural gas, and now propane, but it's based on what the Commission believes those real costs are going to be over time.

Another change that we're proposing is to distinguish between natural gas and propane. Historically, the energy standards have treated natural gas and propane as being pretty much the same thing. Of course, out in the real world, they're very different in the way they're produced, the way they're priced, and the way they're delivered. And there's areas of the state where natural gas is simply not an available option, and so the standards have been pushing people towards using propane in those cases, because the standards had a tendency to favor natural gas as the lower cost alternative.

I practice, propane is more expensive than natural gas. And so we wanted to eliminate that kind of artificial assumption by identifying the actual costs of propane and valuing them appropriately. So when trade-offs are done in areas where natural gas is not available, under the TDV proposal you would use the values for propane which are based on the forecasted costs of propane at their actual values.

Next. So another policy choice here is what version of Time Dependent Valuation should the Commission adopt. There's lots of ways that you could calculate these values. We've spent the last three years developing what we think is a rational and reasonable way to do that. So one of the recommendations that we're making is that the Commission adopt our methodology. And there's a couple of key factors that we used in developing this methodology.

One is that we wanted to base it on publicly available data sources, so that everybody could see where the sources of data came from.

And the Commission has a forecasting office with highly trained professionals who develop long-term forecasts, and we have used those forecasts in developing the TDV methodology. One of the advantages of this is that the calculations that result from this methodology can be repeated over time. So if forecasts change and the future cost of energy appears to be different than what was assumed, there will be a repeatable way to revise those forecasts, and to adjust them.

We do not, however, expect that the Commission will be changing these values frequently. The current source energy valuation has pretty much been in place since 1978. There have been some adjustments to the numbers that you use for doing life cycle costing of proposed measures over time, but these aren't values that get changed willy-nilly all the time, and we expect that once this is adopted, that the fundamental TDV approach will remain pretty steady over time.

There's also, as I mentioned, a number of engineering analysis upgrades that we're proposing. The fundamental one is that we want the HVAC energy to be calculated on an hourly basis. Right now, for the residential energy analysis of buildings, there's an hourly load calculated, but when you go to apply the efficiency of the HVAC equipment you simply divide it through by an annual seasonal efficiency number, which has the effect of saying that it doesn't matter which hour, whether it's hot, cold, medium temperatures, when the savings for that HVAC equipment occurs.

In order to do what we want to do, you have to model the performance of the equipment hour by hour, and calculate the savings hour by hour. And so that's a fairly significant enhancement to the way residential equipment modeling is done right now.

On the non-residential side it's not such a big change, because we've been using DOE 2, which is an hourly equipment model. Likewise, other measures such as water heating and cool roofs, and the whole range of measures that we deal with under Title 24 would have an hour by hour savings calculation under TDV, rather than an annual savings calculation.

So how would TDV be used? The first one, which is the one I've been talking about, is when a designer chooses to do performance trade-offs amongst measures in their building design, rather than simply taking the prescriptive package and saying okay, I'm just going to do what the package tells me to. This is an optional procedure that a designer goes through. They're not required to do this. They can simply take the prescriptive package measures and apply them.

But we're proposing that when optional performance trade-offs are done, that they be done using Time Dependent Valuation, again, so that we can give a clear signal to select those measures which have better on peak performance.

TDV can also be used for evaluating new compliance options. As new technologies and new design methods become available and become accepted under Title 24, we would recommend that they be likewise developed so that they can calculate their savings using TDV.

Another use for economic analysis in Title 24, of course, is when new measures are proposed for adoption by the standards. Any measure that's going to be adopted into the standards has to be shown to be cost effective, and the cost effectiveness calculations historically have been done assuming a flat valuation of energy. TDV provides us a method to value those savings according to their hour by hour performance, and TDV would give greater cost effectiveness to measures that save energy on peak versus alternative measures that might not save energy on peak.

We think using TDV for the purpose of improving cost effectiveness or new standards requirements is a good and consistent thing to do. We are not, however, recommending at this point that all of the measures that currently are adopted into the standards be reevaluated, in light of Time Dependent Valuation. There's a longstanding precedent that the current standard is the current standard, and we move forward from that point. Going all the way back to ground zero and reevaluating all the standards would cause, I think, a lot more confusion in the compliance world than is really worth it.

But starting here and moving forward, we think it makes a lot of sense to use TDV both for performance trade-offs and for demonstrating cost effectiveness of new measures under the standards.

Next slide. So getting a little deeper

into some of the methodology choices that we made. I've got in parentheses what our recommendations are, and each one of these bullets is sort of one of the questions that we've asked ourselves and we have been asked by others.

The first one is should we true the economic value of energy now, should we true that up to the same level of economic value that was used when the 1992 standards were developed, which was the last really major upgrade to Title 24. Energy costs in 1992 were different from energy costs now. And for a while we actually thought that that would be a good thing to do, because fundamentally, the energy costs that you assume determine what you -- what's cost effective to require in the standards. We actually thought about that a long time and decided it's really not such a good idea.

It makes more sense, when adopting new measures into the standards, and making trade-offs within the standards, to use your best representation of what current costs are and what you expect current costs to be out in the next 15 to 30 years, because that's when the decisions, that's when the measures that you install, based on the decisions today, will be operating. So we're not recommending truing up, or sort of lining up the current economic assumptions to the economic assumptions that we used ten years ago.

The next question was, if the TDV numbers are based on forecasts of energy costs, whose forecasts should we use. Utilities have forecasters, the PUC has forecasters, the Energy Commission has forecasters, there's independent economists out there that have forecasters. There's forecast areas.

Well, as I mentioned earlier, we want publicly available data and we want repeatable data. And the CEC forecasters have basically been in the business of providing that for a long time, and they're expected to continue to stay in their business. That, plus the fact that the Commission Staff would prefer that we use the CEC forecasts, we elected to use the CEC forecast.

So this forecasting, as I'll talk about in a little bit, includes forecasts for electricity and energy costs that go 30 years out, based on the current best information about what those costs are going to be. And that seems to us to be as good a forecast as any to use, and certainly most appropriate to the present purpose.

Another element of our methodology is the transmission and distribution costs. Transmission and distribution costs are not a huge part of the overall costs, but they are highly driven by peak demands on the utility system. And the economists on our team developed a very clever method for allocating the transmission and distribution costs as a function of temperature. So it's a time dependent allocation of those costs.

There's other ways that people can allocate peak costs. Pick the -- sort of there's ways of the time of use rates that the utilities charge, and so forth. But because it has to work with the weather tapes and with the performance calculation methods that are currently in place, we recommend that this time dependent allocation of the transmission and distribution costs be used.

Another decision was whether to use just the marginal costs of energy or to use the total costs of energy. The total costs of energy are essentially what the consumer sees when they pay their rates. There's variations in how those costs get allocated through the rates, but ultimately, the costs of operating the energy system all fall to the people who are running the buildings. And so it is our recommendation that we not use just the marginal costs, but that we use costs based on the overall revenue requirements to the energy system.

The final question that we grappled with is should we use environmental externalities. Environmental externalities are very tough to get a handle on. But if you look at the Warren-Alquist Act, the Warren-Alquist Act says that the Commission should use environmental externalities. The PUC, in its development of costs which are used by the utility programs in calculating the cost effectiveness of their energy management programs, use an environmental externality term.

And we've developed what we think is a rational and reasonable method for assigning environmental externality costs to TDV. So we're recommending that they be included, as well. That one, however, might be the trickiest of all of these. So I'll show you an illustration later on of how much difference it makes in the outcome.

Next slide. So another question we get

asked a lot s why don't you just use rates? Well, the first response to that question is well, which rate, you know? Every utility has different rates. They have different rate structures, they have different rates for different classes within their customer base. The rates change over time, the rates -- next one -- the rates include a whole bunch of policy choices about equity, and cross subsidization of customers.

Next one. The rates also have a different effect on how they assign the high cost periods and how they dilute the price signal than what we've tried to develop in TDV. So we spent a lot of time thinking about whether or not we could just use rates, and decided that it was really going to raise a whole lot more questions than it was going to answer. It's been my experience that people that know a lot about how the utility rates are set and how they're used can argue for days on end on this subject and have a ball while they're doing it, and not actually come up with an answer that would suit our purpose for TDV.

So we chose a method that reflects the long-term costs to the system. It's based on 30-year forecasts, it's based on -- for generation.

It's based on the utility's transmission and distribution cost experience. It's trued up to the overall revenues required to run the utility system, and we think it provides a more rational and more stable basis for energy standards than what we've currently got.

So, let me give you a graphic illustration of how this works. What I've got here is a chart that goes through from a typical Monday through a typical Friday in the summer, and the vertical axis is the value of the energy.

So under the current scheme we've got a flat energy valuation. Basically every hour of every one of those days, the energy has the same value. So if you save a kilowatt during -- if you save a kilowatt hour at 4:00 o'clock in the afternoon on the hottest day there, and you compare that to something that saves a kilowatt hour in the middle of the night, those kilowatt hours are given the same value. It doesn't matter when those savings occur.

Under Time Dependent Valuation, what we have is an hourly value of the energy. And so if you have, if you're saving during that peak hour, which is up at the top of those curves, the value saved in that kilowatt hour is given a fairly high number, or a relatively high number, compared to if you save it during one of those hours that occurs kind of at the bottom of that curve.

And so the actual effect over the course of a season, or over the course of a year, will depend a lot on how the particular measure works and how it interacts with the rest of the building. And that'll determine when the savings occur, and it'll determine when we apply the value of the savings. But that's actually the way it works in the real world. And that's the way the utility system experiences the costs of supplying peak energy from all the buildings out there. It's also the way an individual building owner experiences peak costs if they're on a kind of a time varying rate.

So how do we build this up? Well, let's -- let me just show you the components. This is for the electricity Time Dependent Valuation factors. The first step is we start with the Energy Commission's forecast of commodity costs. And these are -- there are hourly generation costs for -- I mean, there's an hourly shape for the generation costs that the Commission has developed, and then there are annual generation cost forecasts that go out for the next 30 years.

So using those two, we developed a shape for the generation cost. And there are hours when the generation cost is high, there are hours when the generation cost is low.

Next, we apply the transmission and distribution costs, and as I mentioned, we do this as a function of temperature. And the temperature in this case is the temperature that shows up on the Energy Commission's weather tape, the hourly weather temperature values for each of the 16 climate zones. And the T&D costs are also different for each of the utilities. So we've got the utilities mapped to the 16 climate zones. We picked the peak temperature hours when those occur, and we assign the transmission and distribution costs to those peak hours.

So if you've got, in this case, we have a Wednesday that has a higher temperature than the other days of the week, and it gets a higher cost because the transmission and distribution costs get allocated.

You notice that the green, the generation costs that I put up there first are the same for every day of the week, and that's because the forecast is based on what's going on all the way around the state. The forecast doesn't know when it's going to be hot and when it's going to be cold. So the forecast knows that costs are higher during weekdays than they are on weekends, and they know they're higher in the afternoon than they are during the day, but they don't know anything about the temperatures.

The T&D factor that we're adding on here does know about the temperatures, and that's what gives a little more climate sensitivity to the T&D -- or to the TDV values.

And the third thing we do is we bring this all up to the revenue requirements for the utility system, and the revenue requirements part, which is this purple flat part at the bottom here, doesn't change hour by hour. This reflects the costs of reading the meters, preparing the bills, paying the taxes, you know, all the kind of flat costs that are embedded in the cost of -- embedded in the revenue requirements.

And then, finally -- well, not finally. Second to finally, we add on the environmental externality, the environmental adder, we're calling it here, which is that kind of green overlay that lies on top. This is proportional to the generation costs, and it goes up during the peak generation hours, which is what actually happens out there in the world. That's when they bring on all the peaker plants, which are the least efficient in terms of heat rate, and they're the most polluting in terms of environmental effects.

The cost of the environmental adder, as we've developed it, is derived from the CO2 and NOx markets for emissions trading. It's actually a fairly conservative approach, but it does give us a way to assign an environmental externality.

And you notice that the vertical axis here has been the forecast costs. We can derive costs for all of this stuff, but when you finally bring it into Title 24 compliance, the Warren-Alquist Act actually says that it should be in terms of energy units per square foot. So we take these costs and we do the final step. We convert this all -- hit it again -- into equivalent energy units. And we call these TDV Energy Units. And that's just a unit change.

MR. RAYMER: I have a question.

MR. MAHONE: Yes.

MR. RAYMER: Bob Raymer, with CBIA. Could you explain once again about the hot afternoon?

MR. MAHONE: Yeah. The hot afternoon is when we allocate the transmission and distribution cost component. So we take the -- the others are all -- the generation cost is how much it costs to generate the power. The transmission and distribution cost is based on what the utility system costs are for power lines, you know, transformers, substations, and all that stuff.

And the cost of transmission and distribution to the utilities is very dependent on when the peak demand occurs, because you've got to size all of that part of the system to meet the peak load. So if you bump up the peak load, wham, the cost of transmission and distribution goes up. And so we developed a method that assigns all of those T&D costs just to the hottest hours of the summer.

COMMISSIONER PERNELL: So, just to follow up on Bob's question. The T&D costs that are on the other four graphs, is that embedded in the revenue neutral adjustment down in the bottom bar? I mean, your assumption is that there is no T&D costs until it gets -- until the temperature gets up certain degrees. Is --

MR. MAHONE: Yeah, that's essentially it. Do you want to expand on that a little, Gary, or do you --

MR. FERNSTROM: Yeah. Gary Fernstrom, PG&E.

When you look at our distribution system, the distribution system is built in order to serve the peak load. The reality is that in hot climate zones, those systems need to be built much more robustly, much stronger, and they're more expensive. Yet the recovery of that investment is worse, or slower, because that maximum capacity is being used for rarely. So the T&D system, in terms of its cost and the recovery of that cost, is very temperature dependent.

The generation forecast, on the other hand, can't capture that temperature dependency, that weather dependency. So the only way we have of adding that into the Time Dependent Values is by using this distribution factor.

COMMISSIONER ROSENFELD: I'm happy with what you're doing, but let me still ask a question.

The peak demand is -- electrical equipment and transmission lines, and so on, are limited by the temperature that they can handle. The temperature, in turn, comes from two different things. One, it may be hot. And hugely correlated with that, there's more power being drawn by air conditioners. So when a transmission line's hot, it's sort of half because of -- losses, and half because of the ambient temperature.

And what you are doing, I think, is just putting all that together and saying we're going to put on a hot afternoon cost and charge most of the T&D annual costs to those hot afternoons.

MR. FERNSTROM: Yes, we actually weren't figuring in the factor that you mentioned, and that is the reduction in capacity on account of high temperature. We were factoring in more the increase in load, and the extent to which the system needs to be built to handle those peak loads.

COMMISSIONER ROSENFELD: Okay.

MR. RAYMER: Where do you get those costs from? You get -- the Energy Commission forecasting gets you this basis. Where does the yellow come from?

MR. FERNSTROM: The way the T&D costs were derived was by looking at each utility's capital investment cost in distribution in general, and then allocating that cost to different climate zones, depending upon the peakiness, if you will, of the loads in those climate zones.

Does that answer your question, Bob?

MR. RAYMER: I'm beginning to grasp it. I'm just trying to think ahead, how does -- has Ken been able to plug this into Micropas, you know. What long term assumptions did he make on something like -- this is important, but how does one modify a computer program to do an accurate job of this over the long haul?

MR. FERNSTROM: Well, E3 took all of these factors and, in the economics cookbook, built them into hourly tables for each of the different climate zones. So given to Ken Nittler and the others who do the computer programs, John McHugh, for example, at HMG, was a table of 8760 hourly values fore each climate zone. And they contain the composite of all these factors we're talking about.

And looking at that table, we see the hourly factors being more peaky, or higher, for Fresno, for example, than Oakland.

MR. MAHONE: Yeah. Essentially, if you take the top of all these curves that we built up here, and for each hour you record that value, you end up with 8,760 values, because that's how many hours there are in a year. And we just take each one of those values for each hour and multiply it by the savings in energy that's calculated for each hour.

MR. FERNSTROM: Now, I'd like to emphasize, while there are a lot of values, the implementation is simplified so that compliance ought to be able to be calculated similarly to the way it is now.

MR. MAHONE: But actually we're getting ahead of ourselves here.

MR. WEATHERWAX: Could I have one other question -- Bob Weatherwax, my name -- on the basic generation cost. And it seems to me I heard you say, Doug, that they were the same every day of the week, so are we looking at a typical weekday forecast for each month of the year?

MR. MAHONE: Yeah.

MR. WEATHERWAX: Which is, it's somewhat different generally than Prosym or the other codes have done it in the past, which have used, typically used historical years in order to derive load shapes.

MR. MAHONE: The generation load shape has different values for each of the 12 months. Within each month there are weekday values and weekend values, and the weekday values I believe are the same for every -- yeah, here's our economist, Snuller Price.

MR. PRICE: Hi, there. I can just say a few words about the generation cost price shape. It's, I believe, a typical --

COMMISSIONER PERNELL: Could I get you to state your name for the recorder?

MR. PRICE: Oh, sure. My name is Snuller Price, with E3.

There's -- and the Commission developed the shape for the generation costs, but I can speak a few words about it. It's a typical week for each month of the year. So that means that there's a typical Sunday for January, Monday for January, and so on, that go into the generation cost component.

So that shape is then multiplied by a long run forecast of what the average prices are going to be, going out 15 and 30 years.

MR. WEATHERWAX: So the normal annual peak, what, that'll be found on a Monday or a Friday, in something like July or August?

MR. PRICE: Yeah. I believe it's -- I think it's usually Mondays.

MR. WEATHERWAX: So that drawing perhaps is just a tad stylized there.

MR. PRICE: Yeah. It's a bit stylized, yeah.

MR. ALCORN: I need to interrupt here for just a moment, and say that time is a little constrained on this topic. Thank you.

MR. MAHONE: I will keep going here. Next one.

We did a similar exercise for natural gas and propane, but in this case it's an annual curve because there's not an hourly variation. So the first step is the CEC's forecast of gas commodity cost month by month. Second step is to add on the revenue requirement adjustment, or the revenue neutrality adjustment, which, again, accounts for all those kind of fees and flat costs, metering and billing, and so forth.

The third one, then, is an environmental externality that we add on. And finally, we convert the forecast costs into TDV energy value, an equivalent energy value. And we've done this, this is for natural gas, but we did a similar thing for propane based on the DOE natural -- national forecast for energy prices, because propane pretty much follows -- for oil prices, I'm sorry. Propane pretty much follows the oil price market.

Next. So back to electricity for a second here. Just in terms of how big a chunk of the annual energy use do these things turn out to be, the bottom chunk is the generation cost. The next, thinner chunk, shown in dark red here, is the transmission and distribution costs. And you can see it's not a -- it's not a big part of the total value, but we're assigning it to the hottest hours, so we're using it as a way to provide a price signal or a cost signal to measures that perform well during hot hours.

The next one, the light blue, is the revenue neutrality adjustment, which we're referring to here as retail. And then finally, the top yellow bar is the environmental adder portion. And again, it's not a big chunk, but we think it's a worthwhile chunk.

MR. DeLAURA: Doug, could I ask a quick question.

MR. MAHONE: Yes.

MR. DeLAURA: Pardon my froggy voice here. Could you go back to the previous slide, under gas? I just had a question of clarification.

MR. MAHONE: One more back.

MR. DeLAURA: Just one more back. You had mentioned the forecast of gas, and is this a national forecast or is it an in-state forecast?

MR. MAHONE: It's an in-state forecast. It's done by the Energy Commission for what they expect costs to be.

MR. DeLAURA: And is it also based on supplies of gas that are just in California, or is it nationally on a grid that's infused?

MR. MAHONE: Let's let Snuller describe this a little more.

MR. PRICE: Yeah. Snuller Price again. Just a couple of words. I believe the way the forecast is done is with basically a general equilibrium model, trying to forecast the price at the border, and then on top of that is added the prices for delivery, so the -- and then distribution depending on what customer class.

MR. RAYMER: I have a question on the next chart, going forward.

MR. MAHONE: On this one?

MR. RAYMER: Yeah. What impact does the recent PUC decision to allow some of the large non-residential customers to maintain those long-term contracts, what impact does that have on this?

MR. MAHONE: Do we know that for this forecast yet, with the DWR?

MR. PRICE: Yeah. The question was what impact does the PUC's latest decision on big customers have on this forecast.

MR. FERNSTROM: Well, Gary Fernstrom, from PG&E. Let me take a shot at trying to answer that. The decision about how the costs are allocated and who pays what doesn't affect the basic cost structure, and what we're looking at is the basic cost structure here.

Snuller, would you agree with that

answer?

MR. PRICE: Yeah. That's right.

MR. RAYMER: I'm just thinking during the AB 970 update, and this gets more into the politics of the situation, residential picked up about a two to one conservation percentage versus non-residential, and we were wondering if maybe the weighting would be changing this time around, but that's getting way ahead of ourselves.

MR. FERNSTROM: Well, your question zeroes in on the basic issue of why we're recommending using costs instead of prices, because the allocation of costs to different customer classes gets to be a political issue and it isn't always necessarily done consistent with the way economics work.

MR. RAYMER: We think it's a good thing to share pain, so it's --

MR. FERNSTROM: Well, the pain in this, such as it is, I think is equitably shared between the residential and commercial class for buildings.

MR. WEATHERWAX: There's one other question about the manner in which the truing up of the rates is done. I'm kind of accustomed the way the PUC does it, where they have marginal costs for, say, generation and for transmission, and then fixed costs, and then they'll scale them all up proportionately in order to accommodate the full loading costs that are needed to carry revenue.

In this case, you apply the truing up as a flat adder for every hour. Did you do any thinking about trying to apportion that among the different categories, and if not, why not?

MR. PRICE: Yeah. What you're talking about there is the difference between using an adder to get to kind of the total rate level, versus a multiplier. Because some of the T&D costs are quite spiky, and so on, if you gave a proportional you end up with very, you know, very spiky prices on peak for the electric. For the gas, you'll end up with almost identical answer, because the values are around the same level.

So again, you know, we've looked at it both ways, and the adder approach seems to give a better result.

MR. WEATHERWAX: How do you define that?

MR. PRICE: How do I define better?

MR. WEATHERWAX: Uh-huh.

MR. PRICE: I guess it's sort of a subjective --

MR. FERNSTROM: Well -- Gary, from PG&E again. I think we're defining better as peaking enough to give a signal, but not so peaky that it's unreasonable.

MR. DeLAURA: This is Lance from SoCalGas. A question just generally going back to a couple of these points, Bob's, and then just a couple of general questions. We don't have to spend a lot of time on it at the moment.

But there's a number of assumptions that are embedded in TDV, at least in this beginning discussion. Are there any comparisons of the results for folks to be able to look at as an example of this question, or we talked about the multiplier of three compared to the assumptions that are in TDV. Are there some outcomes that someone could look at that would show sort of a T-bar comparison, so you can get a sense of the trend and where this is?

MR. MAHONE: Yeah. I'll be showing you a number of comparisons between source energy and TDV. In terms of how does TDV work with, you know, one variation of the underlying assumptions versus another variation, we spent a lot of time looking at variations. It's the kind of thing that can sort of drive you crazy.

What we finally settled on, we think is a reasonable compromise of a number of judgment calls. And we've looked at some variations that people have suggested over the last six months, it's a fairly labor intensive thing to do, but in general we haven't found most of the tweaks to make really very much of a difference in the outcome. The method turns out to be fairly robust.

We can make tweaks that make it more peaky, or make tweaks that make it a little bit less peaky. When you finally get to the bottom line, though, which is how does this affect the measures that Title 24 would occur, most of those little tweaks don't change the outcome very much.

MR. RAYMER: Lance -- Bob Raymer. We did, we were very interested in the bottom line as we were going forward in this, and we took our AB 970 base case houses that we were using for marketable approach, and we applied this to it. And so later on, I'm sure we can get into what we found.

MR. DeLAURA: Okay, great. That's good to know.

MR. MAHONE: Okay. Well, let me -- oh, some other questions?

MR. AHMED: A.Y. Ahmed, consultant to Southern California Gas. I was just looking at that graph. It looks like the externalities are almost equal to -- unless this graph is not very accurate -- to the T&D cost.

MR. MAHONE: Uh-huh.

MR. AHMED: And would you say they occur concurrently or at the same time as the T&D costs, as well, because of the peaking plants?

MR. MAHONE: No. The T&D costs are basically another way, or on top of the generation costs. They follow the cost of the generation. So there are daily peaks, but they're not correlated directly to temperature, because the generation costs aren't correlated directly to temperature.

The only part that does show up on the hottest hours are the -- well, that occur only on the hottest hours are the T&D costs. Some of the environmental costs and some of the generation costs obviously are concurrent with that hottest hour, as well.

MR. FERNSTROM: Doug, would you restate that, because I'm not sure it came across clearly. The -- the question about whether the T&D costs are temperature sensitive, and whether or not they line up with the environmental costs.

MR. MAHONE: Well, yeah. What I was saying was the environmental costs have a time varying nature to them, but the environmental costs are not a function of temperature. Whereas the T&D costs are a function of temperature, and in general, the hottest temperatures coincide with the peak generation cost times, as well, so they tend to add up during those hours.

MR. FERNSTROM: Thank you.

COMMISSIONER ROSENFELD: Doug, this is Art Rosenfeld, Commissioner. Again, I think that this is not a big deal, but surely peaking plants on hot afternoons are dirtier, which means more NOx and SOx, and less efficient, which means more CO2. So, I mean, I think a more satisfactory answer will be that it's not a big deal and you just didn't bother to do it. But there is a time factor in time and temperature dependence to externalities.

MR. PENNINGTON: In reality, in their analysis there is a difference for on peak versus shoulder and off peak for the environmental externalities.

COMMISSIONER ROSENFELD: Oh, okay. So you did try to take care of it.

MR. MAHONE: Yeah. It does, the environmental costs are higher during the peaking hours, and --

COMMISSIONER ROSENFELD: I didn't hear you say that.

MR. MAHONE: It's just that -- maybe you can say it better than I can.

MR. PRICE: Just to clarify that. The environmental externality component exists in every hour, and therefore, you know, where the T&D costs are very peaky, if you look at those, the environmental costs are out of shape but they're not very peaky.

And so when you're looking at an average chart like this, and you see a bar that shows the environmental piece is about the same size as the T&D piece, that's a little misleading for the peak hours. The peak hours would have a much larger T&D component relative to the environmental component during those few peak hours, and then in the off peak there would be an environmental component and no T&D component.

MR. AHMED: That's true, but in the off peak there will be no T&D costs --

MR. PRICE: That's right.

MR. AHMED: -- but there will be an environmental adder.

MR. PRICE: That's right.

MR. AHMED: On peak, as Commissioner Rosenfeld was mentioning, because of the dirtier plants, the environmental adder should be higher.

MR. PRICE: It is.

MR. AHMED: Okay. I just wanted to understand that.

MR. MAHONE: Thanks for all the help there.

Next. This table, which I'm sure you cannot read, and even on the paper version you might be able to read it, lists all the sources of data that were used for developing the TDV method. If you want to actually see it in a form that you can read it, the TDV cookbook, which is the -- at the back third of the big handout, on page 11, has this same table in ten point type, and should be readable by most.

COMMISSIONER ROSENFELD: It's a lot better.

MR. MAHONE: What?

COMMISSIONER ROSENFELD: I said it's a lot better.

MR. MAHONE: It's a lot better, yeah. I wasn't going to spend a whole lot of time going through this, but what this table does show is the source for the electricity class shapes, the retail rate forecasts, the wholesale rate forecasts, and where they come from, primarily from the Energy Commission forecasting group, and whether or not these factors vary by climate zone. And some of them do, and some of them don't.

But these are all repeatable and available data sources. For future sources of data, you can go back to the forecasting office, for example, or to DOE, and get updated forecast costs. And for how these all get put together and the methodology, it's written up in this TDV cookbook document at the back of the handout.

There are also spreadsheets available for anybody who wants to really get into the, you know, nitty-gritties of how the calculations are done. We used, we developed big spreadsheets for implementing this methodology, and it's open to inspection by anybody who'd like to look at it.

So just to wrap up, two final slides here. How does TDV compliance work out in the field. As Bob Raymer mentioned, the builders and others are really a whole lot more interested in what's the bottom line than they are in the arcana of our methodology.

It's primarily going to be used for performance trade-offs, and evaluation of the savings will be using the TDV factors rather than the old source factors. And I've got a whole presentation that we'll get to a little after lunch, that compares how these compliance outcomes work for a bunch of scenarios.

The compliance runs that are done using the performance method using Micropas on the residential side, EnergyPro typically on the non-res side, will be done the same way they're done right now. The person who's doing the compliance will enter the proposed building design as they normally do. The standard building design will be automatically generated as it normally is. The savings will be calculated as they normally are, except that we'll be doing it hour by hour. And then internally, the software will apply the hourly TDV factors. I'm getting a little ahead of myself.

The compliance software will be enhanced so that it can do hourly calculations of energy efficiency for both the base and the proposed run. Those hourly savings which are calculated as the difference between the proposed and the base, will be multiplied each hour by a TDV value, and that will give the hourly energy savings for the whole building, you know, using all the measures that are in the proposed design. And then those will get totaled up to calculate the annual savings.

And then, finally, the last step in the process is the computer spits out a compliance report that says thumbs up/thumbs down, pass/fail, and gives the compliance margin. The only real difference there will be that the compliance margin will no longer be reported out in terms of source energy per square foot, it'll be reported out in terms of TDV energy per square foot.

So what's the actual change that we're proposing here? The primary change is very simple. There's a definition in Title 24 for source energy. Delete that, and then replace that with a definition of a new term, which we're calling TDV energy. And, you know, if you want to read the actual language here, it's on page 37 of the report. We have in the definition a general description of what TDV energy is, and then we cite a CEC report which we're recommending the Commission's adoption of the TDV cookbook, which is the kind of formal description of how the TDV factors are derived from the data sources. So that's the basic proposal. Change source energy to TDV energy, using this methodology.

Then the other changes will be a series of alternative calculation method changes. This document that the Commission publishes called the ACM Approval Manual, that lists all the rules for how the computer programs have to generate the standard building design and how they calculate the base case assumptions for each measure, and there's a number of fairly detailed adjustments that will be proposed for those. And we have presentations by Bruce Wilcox and Charles Eley, who will be going over that.

There will also be a change for propane versus natural gas. We'll basically recommend that for areas for which natural gas is not available, that the standards assume that propane is the fuel. And then if a builder wants to make a trade-off between a propane furnace and a heat pump, for example, those trade-offs would be valued using the actual forecast costs for propane and electricity that, again, that we've developed here.

And then the final change will be some minor adjustments, as I was just describing, for the output reports that the computers print out.

So that's the practical change, and that's the end of the first part of my presentation. We've got a few minutes left, I think, for a few more questions. Then following that, Bruce Wilcox and Charles Eley will talk about some of the engineering modeling changes that we're proposing to make. I think that will take us up to lunchtime, and then after lunch we have a presentation showing some of the trade-off outcomes for both residential and non-residential buildings.

MR. FERNSTROM: Doug, I'd like to make a comment about the economics. We've spent three years developing the economic basis for this.

It's robust, it's defensible, it's repeatable. There are subtleties in it that can be questioned. We think the economics are yielding results implications that all the key stakeholders can live with. We're sure that there will be room for questioning subtleties in the economics if key stakeholders are dissatisfied with the outcomes.

MR. MAHONE: I would just add to that. We've already been through several rounds of kind of "what if-ing" on various tweaks to the economics methodology. And we keep finding that the method is robust enough that those tweaks don't really produce a very noticeable change on the bottom line, which is how does this affect the measures.

Yes. Sure, come on up. You can use this podium for the question.

MS. COUGHLIN: My name is Katie Coughlin, and I work at Lawrence Berkeley Labs, in the Energy Analysis Department.

And we've actually been developing some cost analysis for some of the appliance standards for the whole country. So we've looked at a lot of data, and I think we have a very different approach because we've been looking at the correlations effectively between system loads, system prices, and temperature.

And there are a lot of issues that one could consider, but one that seems to be important in projecting costs into the future is the assumption when you -- essentially, by not considering an explicit model between price and load, you're assuming it's for the least cost dispatch for your system. And we find that the data suggests that there's actually quite significant deviation from the least cost dispatch in the real world. And I'm wondering if you've considered this and how it impacts your cost assessments.

MR. RAYMER: Could you give an example? Bob Raymer, CBIA. Can you maybe give an example that comes to mind of that?

MS. COUGHLIN: An example of deviation, or --

MR. RAYMER: Well, what you perceive, what you think your gut feeling is as what would actually happen out there, as compared to what he's been talking about.

MS. COUGHLIN: Well, I guess one -- I mean, in the context of this discussion, you would end up over-valuing peak savings. Because the assumption that your highest cost generation only comes in when you have your highest loads is -- I mean, there's different ways of measuring to what degree that's not true. But to the extent that it isn't true, you end up using expensive generation even when your loads are in a sort of medium high range.

So your valuation of savings is a bit skewed. You put too much valuation on savings at the top of the peak, and not enough in savings that are sort of in the mid-range.

MR. FERNSTROM: Well, let me take a shot at answering that. We've broken the price structure down into generation and transmission and distribution principally. For the generation component, we're using the CEC forecast. So to the extent that there are some part peak and off peak periods when the cost is fairly high, that's likely captured by the forecast, similar to the approach that you're suggesting.

For the transmission and distribution component, we're looking at the cost structure, which probably isn't correctly captured in prices on account of the political and social need to wash that out or average it out. And we think that in terms of driving toward the least cost operation of the utility system, and consequently the lowest rates for all ratepayers, it's important to look at the cost structure and not the price structure for transmission and distribution.

Snu, do you have anything you'd like to add to that?

MR. PRICE: Yeah, I guess I would just like to say that I think we are -- I think we're actually capturing that effect that you're talking about. We have two components, really, that are driving the time variation of transmission and distribution, which is directly linked to loads. And I think -- I don't think you're disagreeing that the costs of the transmission and distribution system are directly tied to the loads. And that's in terms of the capacity of expansion by new substations, transmission lines, and those components.

Then there's another piece, which is the generation piece. And we haven't tried to assign high generation costs for the highest load periods. What we've done is forecast it the best we can, typical week shape, that isn't directly tied to the temperature, and use that. So, yes, they are higher in the summer, but we observe that. We haven't tried to derive that directly to loads.

I don't know if that helps.

MR. PENNINGTON: Okay. Pardon me. Does LBL develop, have they developed an hourly forecast for electricity for appliance standards analysis purposes?

MS. COUGHLIN: Not -- no. I mean, we're in the stage of still working out the methodology, so it'll be a few more months to a year before it goes public as part of the standards analysis.

And the forecasting is going to be fairly simple. We're more concerned with developing a regionally accurate description of the impacts for strongly peaking appliances of an efficiency standard, so we're really trying to use historical hourly data. And that's the main focus of this effort for the moment.

MR. MAHONE: One of the other -- I'm sorry, Bill, did I interrupt you?

MR. PENNINGTON: Well, it seems like, you know, if you have information that would suggest a different pattern, it would be useful to see the information. Maybe we could look at it as a sensitivity, or something. I'm not sure what we could do. But It would be interesting to know if you have specific information that shows a different pattern.

MR. WEATHERWAX: There's one other question that comes up. My name is Bob Weatherwax, again. I had understood that for the out 20 years or so, after the forecast was --

MR. MAHONE: Excuse me, Bob. Can I just follow up on --

MR. WEATHERWAX: Well, I'm trying to come back to that same question, if I can.

MR. MAHONE: Oh.

MR. WEATHERWAX: That after that on the generation side, you actually assigned the cost of generation for the hours based on a mixture of very high priced CTs at the very highest load hours, and then steam boilers a little bit below that. And then combined cycle units for the lower cost hours, or the lower heat rate hours, I guess, or however it was measured.

So to some degree that would kind of go against what I think you were saying, Gary, is that in the out years that you would indeed then be doing kind of what she may be having concerns about, about showing the highest generation hours being the only ones with the very high cost?

MR. FERNSTROM: I wasn't suggesting that that would be done any more in the out years of forecast than the near term years. I was just pointing out that the forecast has some inherent smoothing in it that probably isn't present in the market price of electricity, as we look at it hour to hour on a real time basis.

MR. MAHONE: One of the other aspects that we had to grapple with in developing this methodology comes back to the fact that estimating the energy use is done using a computer program that's driven by a climate zone specific weather tape, based on historical data for that weather zone.

So the peak hour or the peak conditions under which the building operates within that simulation world is not tied to any kind of a statewide temperature which would drive statewide generation costs. All the computer program knows is what the temperatures are that that building would be seeing in this average year. And so we couldn't -- we didn't have any rational method to try to predict how the generation shape might change with temperature, because the statewide generation peaks occur according to some kind of a statewide peak temperature event, which may be very different from the peak temperatures that an individual building was experiencing.

So our generation shape is based on a long term average statewide generation shape, whereas our temperature cost allocation is based on the climate tape temperature specific conditions that the building being simulated is experiencing.

MR. ALCORN: Thank you for these questions and comments. It's -- I'm sorry that we're going to have to move on to the next topic.

MR. HAMMON: Bryan, can I ask two quick questions? I think they're pretty quick.

MR. ALCORN: Okay.

MR. HAMMON: And Rob Hammon, from ConSol.

I'll ask them -- they're disparate questions, but one is in your last slide you mentioned you're adjusting the rules for propane and natural gas, and you're talking about implementing different rules in areas that don't have gas. And I'm just wondering how you think that would be implemented.

Let me ask the second question, which is totally independent. Right now, when you do a compliance run, we get results that are TBtus per square foot per year. And from that, somebody can do an economic analysis of if I do this feature, it may have this impact to my bill. And I'm just curious how somebody might do that, based upon the new TDV results. And looking a little sideways, there's an open proceeding on home energy efficiency ratings and usually the software that we use for one thing folds over to the other. And I have no idea how this new method might merge into the home energy rating. And Bill, you don't have to go there if you don't want, but I think that's a question to think about.

MR. RAYMER: You said these sere both easy questions.

(Laughter.)

MR. HAMMON: I said simple. They are simple.

MR. MAHONE: I can give you a quick answer, since we're almost out of time and we can talk about this. In terms of the -- somebody taking the results of this run and trying to estimate what the costs for the building would be, what I would -- that's, first of all, not really the purpose of what we're doing, so it'd be kind of trying to figure out how to accommodate that kind of side purpose.

But to the extent we want to accommodate it, because it's an important purpose, what I would recommend is that we ask the compliance reports to print out the site energy consumption. The site energy consumption could be multiplied by an average utility cost to come up with an estimate of the annual costs. And I think that would probably be the simplest way to do that.

MR. FERNSTROM: If you were to take the outcome directly and convert it into a price, what you would essentially find is the revenue requirement, the cost that that represents for the utility system, it wouldn't show you how that gets translated into price.

And with respect to your first question, I don't think the intent is to treat propane and natural gas areas any differently. The intent was simply to capture the correct cost associated with propane or natural gas use. And right now, there is no differentiation. Propane tends to be a little peakier because the supply and distribution effects are more predominant in winter, when propane becomes more scarce.

MR. MAHONE: In terms of how it would be implemented under compliance, under the current rules the standard design has assumed, for example, they have a gas furnace. Well, if it's an area without natural gas, the standard design would be assumed to have a propane furnace. And you would apply the propane costs --

MR. HAMMON: But how do you know to do that? How do you know to apply propane as opposed to natural gas?

MR. MAHONE: We just need a simple workable definition for the building official to decide natural gas is not available. I think that's a fairly simple thing to do.

MR. ALCORN: Thank you, everyone.

MR. MATTINSON: I know you don't want anymore questions, but I want to agree with Rob, which --

COMMISSIONER PERNELL: Well, if I may, I guess, pull rank here a little bit. I think it's important that we get these questions out before we go to a different subject. We don't want to be redundant, nor do we want to be argumentative. But I think we need to get some of these questions out, so --

MR. MATTINSON: I take that as a go ahead.

I agree with Rob, and I think for the same reasons, too, that it seems to me, at least on the residential side, that it's important that the end users, the home occupants, have a connection to this, to the results of this analysis. I mean, I think it's critical that -- I know from my experience, and Rob's, too, as an energy consultant, you need to be able to tell the builder why they are rewarded for doing certain things, and penalized for doing other things. And they have to in turn be able to pass that on to the consumers. And I tend to think that an abstract sort of answer that goes well, it's better for the utility companies, would not really fly.

(Laughter.)

MR. MATTINSON: So it needs to be connected somewhat here, in some way that we can explain, to their bill and their costs and their ability to finance improvements or invest in more energy efficient buildings. And I'm sure that you've considered this in great detail, and I would like to be aware of, as this develops, because I think it is really important.

MR. FERNSTROM: Well, I can tell you from personal experience, to say that it's better for the utility company doesn't fly. However, if you can say that it lowers the cost structure so prices overall in the long run could be lower, that does fly. And that's the argument we're trying to make.

It is the second order effect, I agree, and that makes it a little more complicated to explain. But what we're recommending gets toward lowering the fundamental investment cost in the electric system, and consequently works toward lower bills.

MR. MAHONE: Or it might be simpler just to explain that it reduces the peak demands of your building, which is good for everybody, because we don't have so many rolling blackouts. I mean, I think you can bring it down to fairly basic terms without getting too abstract about it.

MR. FERNSTROM: I mean, where this breaks down is the residential customer can say, and the energy consultant on behalf of the residential customer can say well, we don't pay peak demand charges anyway, what difference does it make.

Well, it may not always be that way. Someday, residential customers may be subject to mandatory real time prices, mandatory time of use prices. We don't know. If that were the case, then they would be seeing these costs, and they'd be real happy with structures that are less peaky and more peak demand friendly.

MR. MATTINSON: Actually, I was expecting that the utilities would follow on with that kind of change in introducing time of use to residential. Is that on the table at this point?

MR. FERNSTROM: Well, speaking for PG&E, what we found in our research is that customers want rate simplification. They don't want to be subject to big variations in the price, even though those variations are incumbent in the cost structure. So there's kind of a mis-match between what customers would like to have and the way the utility system economics really work.

MR. MATTINSON: So that's a no.

COMMISSIONER ROSENFELD: I'll make a comment, if I may. This is Art Rosenfeld, Energy Commissioner.

This is one case where I guess I don't think the Energy Commission and PG&E are swirling in the same direction. The Energy Commission does have load management powers. We will very likely require that all new buildings, including homes, have real time leaders, have computer addressable thermostats, and commercial buildings have computer addressable lighting.

So PG&E withstanding or not, I think these things are going to -- they're technically feasible now, and what's technically feasible tends to eventually come in.

MR. FERNSTROM: Well, Commissioner, I didn't say that PG&E was opposed to these things. I just mentioned what our surveys said our customers wanted.

MR. MATTINSON: Well, you can point your finger at him, and say we didn't do it.

MR. WEATHERWAX: I would've thought, though, that the E7 rate, which was your time of use rate, actually was oversubscribed, so that new users couldn't even get into it. So there was some sufficient interest in the residential sector.

MR. FERNSTROM: Well, we had two rates, E8, which is residential time of use rates, and E7, which is the seasonal --

MR. WEATHERWAX: Seasonal. Well, I mean the E8 is seasonal.

MR. FERNSTROM: -- rate. The issue was that the current meters are expensive, and the PUC advised us that they didn't want us spending a lot of money on the current generation of meters when a new generation of meters might be right around the corner. So the availability of that was reduced on account of the availability of second generation time of use meters at a lower cost.

MR. WARE: My turn. Dave Ware, Owens Corning.

I just want to make a comment both to Bill and the representatives of the building industry over here, as well. I do think it is important, as we think through the TDV activity, that we understand what is actually going on out in the field, and the fact that there is a need for some way to translate those TDV costs into the costs that typically builders and their consumers use.

What's going on right now in the national arena with the International Energy Conservation Code, is there is a proposed code change to change the building rating index from Btus to dollar cost. If, indeed, that passes, and it's highly likely that it may, the energy commissions in all states that are required to show compliance to the federal requirements will have to have some comparison based on costs. TDV is alien to that sector right now. I don't know how to do that. I just -- all I'm saying is that there is a need to at least -- to recognize in this process that if, indeed, the current code arena, and would in California, is going to move to TDV, so that there would be site energy, as what Doug said, or some other way to accommodate what consumers are looking for in incentive programs here in the state, or in the way the Commission deals with this compliance with the federal requirements.

MR. FERNSTROM: Well, I would argue that TDV is absolutely compatible with cost.

COMMISSIONER ROSENFELD: Yeah, TDV is

ahead of the proposal you're making.

MR. WARE: I think I recognize that, as well, but consumers don't understand that concept. It's not entrained in the tax incentives that are on the books right now here in this state, and I don't know that there's a process within the federal -- I'm just, all I'm saying is that those things need to be accounted for and at least broached, as we move through the workshop process here.

COMMISSIONER PERNELL: I think that we've heard that the concern of certain stakeholders is that this actually gets down to the residential customer. And I'm sure that we're going to take that under advisement.

MR. WARE: Okay.

MR. MAHONE: Yeah, just one other comment on that. We're -- as we're proposing it now, the output of TDV is TDV energy. And that's because of the historical habit within Title 24 to reduce everything down to energy units per square foot.

In point of fact, though, the whole TDV methodology was based on dollars, and converting it from dollars into energy is just kind of the last unit conversion that we go through at the end. So if there were to be some desire to keep it in dollars, that would be an easily done thing. I mean there's no fundamental change to the methodology.

What I think is coming up here, though, is the difference between costs and rates. The fact that a residential customer doesn't currently see a time of use rate, the fact that taking the TDV dollars and comparing them to a utility bill isn't necessarily going to give you the same answer because of the way the rates were developed, that was why I made the suggestion that we spit out the site energy and just multiply that by an average utility cost for cents per kilowatt hour, or cents per Btu.

These are all mostly just details of how you do the units, and how you label them, and they can all be accommodated without any fundamental change to the methodology.

MR. ALCORN: Are there anymore questions or comments on this topic? Steve.

MR. GATES: Just a very quick clarification question. I'm Steve Gates, with Hirsch and Associates.

In the transmission and distribution costs, does that actually include the cost of the power plants themselves?

MR. FERNSTROM: No.

MR. GATES: Okay. So that's part of the commodity cost that was referenced before?

MR. FERNSTROM: No. The transmission and distribution cost includes only the pipes and wires, if you will, component.

MR. GATES: Okay. What is the difference between transmission and distribution? It sounds -- that sounds redundant to me, but what does --

MR.FERNSTROM: Well, I think the difference is in the utilization. The distribution lines between the substation and homes or businesses operating at 12 or 21,000 volts, are more subject to peakiness than necessarily the transmission lines that serve a group of substations. And this is because the peakiness of loads depends upon whether they're industrial, commercial, agricultural, and that tends to follow at the substation level more predominantly than at the transmission level.

MR. GATES: Okay. So if there's a -- if

you have a peaking power plant, you know, that only runs, you know, 100 hours a year, or whatever, where does its cost get rolled into this? Is that part of the -- that commodity cost that was in there, or --

MR. FERNSTROM: Yes, that's captured in the commodity cost. Because the output of that plant is sold into the grid, and purchased at the market price of power. Or it's contracted for in advance.

MR. GATES: Yeah. Okay. Yeah, I guess I just need to study this more, because I -- it's not clear to me why the difference there is, you know. Okay, I understand why transmission and distribution could be put on to -- to the peak, but it also seems like certain types of power plants might also be, you know, put into that same category.

MR. FERNSTROM: Well, it could -- there's another reason, too, in addition to the way the system works, and that is that the price of power is captured in the market price and the forecast. So we've tended to roll all plants, regardless of whether they're peakers or not, into the commodity cost, because from an economic perspective that can be captured easier that way.

MR. GATES: Okay.

MR. ALCORN: Are there anymore questions or comments? Okay.

MR. WEATHERWAX: Yeah. There was one thing with respect to transmission versus distribution costs. Looking over the earlier rate cases, they found, I think, that transmission costs are allocated about 85 percent to system load, and about 15 percent to the individual loads at the more distribution substations. Of course, that changes as you move down between primary to secondary distribution, and becomes more and more correlated with the actual local use.

But I didn't see, first of all, I didn't actually see in the stuff I looked at any transmission costs there at all, even though they are modest compared to distribution per se. And I didn't see any spreading of them more towards the allocation to generation than towards the distribution.

MR. FERNSTROM: Snu, can you respond to that?

MR. PRICE: Yeah, for the purposes of the TDV, when we were going towards climate zones, the allocation of the transmission and distribution costs are done in the same hours. And so we've added a distribution component to the transmission component, estimates of the long run incremental costs of transmission plus distribution, allocated them to the same hours.

MR. WEATHERWAX: So that would presumably tend to make it a little peakier for transmission, since in general the transmission is more spread over the -- with the peak load?

MR. PRICE: Actually, it's -- it's actually the opposite. The climate zones tend to be fairly broad regions, and the costs are allocated across, I would say probably an allocation that's probably more in line with the transmission. Now, you know, somewhere in between, than the actual peakiness of a particular distribution feeder, which could be very extreme.

MR. ALCORN: All right. It's, I think, time to move on to the next topic. And Bruce Wilcox, I think is going to be presenting on Time Dependent Valuation.

MR. MAHONE: Yeah, I'll do the next slide. Can we have the next slide, please.

We're going to talk about a number of

engineering enhancements that are being proposed to take advantage of Time Dependent Valuation. One of the primary goals, as I mentioned, is for HVAC systems, we think Title 24 needs to be able to distinguish between an air conditioning system that performs well on peak and an air conditioning system that does not perform well on peak.

Under current Title 24 rules, with an annual simulation, that doesn't happen. So that means we need an hourly equivalent model for the residential side, and we also want to have improved performance curves for the non-residential side, which currently simply apply basic default curves to most systems.

Next. We also want to make similar kinds of hourly modeling enhancements for purposes of water heating, so that we can get a better characterization of the hourly performance of the water heating system, not so much because we think there are particular water heating measures that are terribly time dependent, but because water heating is a big part, especially on the residential side, is a big part of the overall building load, and you can't have detailed envelope in HVAC equipment models and have a stupid water heating model and have it all work together.

Next. Finally, we want to be able to -- we want the method to be able to credit other measures that perform differently on peak and off peak, such as cool roofs and daylighting, attics and ducts, and so forth. So we've developed what we think are the basic engineering enhancements that need to be implemented in order to achieve these goals, and then, as I mentioned, there may be additional enhancements for other measures that get adopted before 2005.

So with that, let me hand the microphone over to Bruce Wilcox, who's going to talk about the residential parts of these.

MR. WILCOX: Thank you, Doug.

Next slide. The main changes in residential modeling that we've put in to handle the TDV situation have to do with air conditioner modeling, heat pump modeling, and modeling of duct systems in attics.

The goal here, as Doug just said, was to capture the main effects and opportunities in the TDV approach for residential buildings. So we've really focused on the systems that have peak effects, and for which the hourly modeling makes a big difference.

The other thing we've done here is to attempt to be as grounded as possible in the compliance world, and so we've made models that are not engineering oriented models, but are compliance oriented models, where they're based on things that we know in the compliance world about the systems that we're trying to use, and have adapted that approach to the hourly TDV calculations.

Next slide, please. So let's first talk about air conditioners. And to put this into perspective, historically -- next -- the calculations for the last 20 years, since the standards first got underway, have always assumed that air conditioning could be handled by calculating the sensible loads and then adding those up to get a total annual sensible load, and just divide by the SEER, the Seasonal Energy Efficiency Ratio of the air conditioner.

In the 2001 standards, we changed that. We developed a conservative assumption for the EER, the Energy Efficiency Ratio, and how it was related to the SEER. SEER is the federally mandated test value that manufacturers are required to provide, and it's basically the only value that California can really require that manufacturers provide for their equipment. So it's fundamental. And part of the modeling is to understand the energy efficiency ratio, EER, which is a slightly different version that has to do with high temperature performance of the air conditioners.

And then we also came up with a set of adjusted SEERs that are -- that take into account the actual temperatures in the various California climates and how the air conditioners would work in each climate zone, based on those temperatures.

Next, please. This plot shows this conservative assumption about EER versus SEER. What this is is a plot of all of the air conditioners, all the split system air conditioners in the database that the Energy Commission has. Across the bottom is the SEER, which is the value, the rated value. And up at the side, over here, is the EER, which is -- SEER is the seasonal value, EER is instantaneous value at 95 degrees outside, and really kind of characterizes the high temperature on peak performance of the air conditioner.

And the thing that was -- that is troublesome about this is that you get all these points out here for air conditioners that have high SEERs, but very basically low EERs. And this is one of the major issues for trying to deal with the on peak performance of air conditioners, that you can't really differentiate between that SEER 14 unit, 14 or 15 unit, and a SEER 10 or 11 unit, both of which perform the same on peak.

Next slide. So we made -- we used that -- actually, back up one slide. This blue line is the assumed relationship that was used in the 2001 standards development, which says that as the air conditioner SEER gets better from 10 to 11 to 11 and a half, the SEER -- the EER gets better. And then, from there on out, we assume that the -- if we don't know anything else about the air conditioner, we assume the EERs can, though, regardless of the SEER.

So, next slide. In making these temperature adjusted SEER calculations, this is the table that's in the current ACM manual in the standards, it says that if you are in Climate Zone 12, and you have a SEER 11 unit, you assume the

EER is 10. And if you're in Climate Zone -- in that same climate zone and you have a SEER 17 unit, you assume that the EER is 12.3. So there's a much lower improvement in the EER on the high temperature performance than there was if you just assumed that SEER.

Next slide. So, we're going to extend that approach in the TDV modeling, and use a more hourly, actual hourly calculation for the compliance model that's based on that same approach. We use the SEER as the primary input -- next -- and we use that same assumed 95 degree EER that I just showed you on the plot, so we're extending the same approach that we used in the 2001 standards, we use the efficiency above 95 degrees, because now we're going to model its hourly, we're going to assume that the efficiency above 95 is based on the tests that PG&E has done on typical air conditioners, and we may be able to pull in some more data from Southern California Edison's testing when that becomes available.

Next. We're allowing for an optional input for -- of EER, which is the 95 degree efficiency number. This is not required to be given out by the manufacturers. It's not necessarily available, but if a manufacturer wanted to show that they had a system that really worked well on peak, then the assumption here is that we'd figure out a system that allowed the compliance user to specify that EER. Probably requires them to specify a particular model of air conditioner at the compliance stage, which is not necessarily simple.

And we're also, in terms of this hourly model, we have to worry about humidity, so we're going to assume that there is a constant 62 degree wet bulb indoor return air.

Next slide. Okay. So here's a graphic that shows how this model will actually work to do hourly calculations. Across the bottom we have the outdoor temperature, and that's the primary driver of efficiency changes that we're looking for here. We want to get -- we want to assess the high outdoor temperature on peak performance of these machines. And up the side here we have the EER, which is the Energy Efficiency Ratio, which is the -- just a measure of the instantaneous efficiency. And so the proposal is that we have, we know one thing, which is the SEER, which is shown here with the large orange dot, that that's an input, that we always know that, and that's the primary input for the calculation.

And then we have the EER here, shown at the default from that table I was -- or, not from the table, from the graph I was showing you earlier, which in this case is a low because whoever was doing this compliance didn't actually say what the EER was going to be. And then the proposal was that between 82 degrees, where the SEER is directly applicable, and 95 degrees, where the EER is applicable, that we simply interpolate the efficiency based on outdoor temperature. Above 95 degrees, we're going to use a constant slope line based on the test data.

Now, one of the trade-offs that's potentially available in this system is if you do specify an EER, and it turns out to be higher than the default, then you would move up to this -- something like this line here, with an EER for a specific unit that worked well on peak. We'd interpolate between the 82 degree SEER line and the EER at 95, and then we would drop down at that same constant slope. So that's the fundamental air conditioning model that's proposed here.

We are also going to remove the fan from the SEER rating and the EER rating, because fans are an issue that we think we want to get into in the standards. It's not actually tested as part of the SEER. It's really a default value that's allowed under the DOE procedure. So we're going to subtract out the default fan, we're going to add back in the average actual fan that's been measured in California. And then we're going to model the fan power as a separate item. So that potentially, if people wanted to use a higher efficiency fan or a combination of a duct system and fan that would deliver the air at less power, that that's a potential credit option in compliance.

All right. So that's the -- for air conditioning. For heat pumps, we have another set of issues which are in some ways very related. The primary input for a heat pump is what's called the HSPF, the Heating Season Performance Factor. This is, again, a seasonal value that DOE requires be calculated and reported. And it doesn't actually tell you how the unit's going to work, necessarily, at any specific outdoor temperature.

So one of the issues is to try and come up with a COP at 47 degrees Fahrenheit, which is one of the primary inputs to the model we're proposing, and we've come up with a default here which is the -- a COP at 47 is equal to .4 times the HSPF.

Next slide. And the other primary input is the capacity of this heat pump to do heating at 47 degrees. And we have a default for that also, which is equal to the rated cooling capacity.

Next. If we were to use a straightforward implementation of the DOE 2.1 heat pump model, which -- the primary inputs of which are these two numbers, the COP at 47 and the capacity at 47, and then there's a set of curves which give you performance and other temperatures.

Next slide. The basis for that default COP is another plot from the Energy Commission database, which is showing the relationship of HSPF to COP for split heat pumps. And that's the same kind of a cloud of data, but we put this line through. That's the .4 times the HSPF line, and it kind of represents a reasonably conservative view of the performance of those machines.

Next slide. Okay. So the other major system in the residential HVAC world that affects the peak energy use in a very significant way is the duct system that's located in an attic. Attics get really hot, and the ducts in the attic respond to that by having an efficiency that's lower on peak than it is during average conditions.

So for ducts in attics, we've developed an approach that adjusts the ACM seasonal efficiencies. For the last two cycles of the standards, the Commission has had a set of calculations for duct efficiency that have a large number of variables, the duct R Value, the duct leakage, the size of the ducts, and so forth. And so what we're going to do is take those efficiency numbers, so we're not changing that approach at all. We're taking those efficiency numbers and adjusting them based on the temperatures in the attic, essentially.

Next slide. All right. Now, this model that we -- the hourly model that does this adjustment is based on assuming the attic temperature and the duct efficiency is driven by the solar temperature on the roof, which is the combination of the outdoor temperature and the solar radiation absorbed on the roof. It includes, this model includes the effects of all the current options that are available. And it's complete invisible to the ACM user that there's no new inputs here that are not already involved in the process.

Next slide. Charles. Yes, we're going to have questions about this at the end.

MR. ELEY: You want to save the questions to the end?

MR. ALCORN: Well, yeah. It seems like we should do that. I'd like to get through the presentations and then address questions.

MR. ELEY: Okay. All right. Next slide, please.

Currently, the water heating calculations for low rise residential are annual. There is no hourly calculation. And these, this is the summary of the method. The water heating energy use is the recovery load, divided by the load dependent energy factor. And the load dependent energy factor will be defined in a minute.

The adjusted recovery load includes the standard recovery load, which is the energy put into the water times the distribution system multiplier, and the distribution system multiplier accounts for losses in the pipes and gives you credit for point of use water heaters, and that sort of thing.

The standard recovery load in the current standards is a function of the conditioned floor area of the specs. There are no gallons per hour, or gallons per day of consumption in the current model. You just put in your conditioned floor area, and this is constrained at -- I forgot where the bottom is, but 2,000 feet or something. But, at any rate.

Then the load dependent energy factor equation is something that was developed in the early nineties, and it's been in the standard since then. It takes the energy factor into account, which is the NAECA rated value, and it makes an adjustment depending on the annual load. So if the loads are great, then the standby component's a little smaller on a percentage basis. And if the loads are very small, the standby component's much larger. So this equation accounts for that.

Next slide, please. So what we're proposing to do is simply adjust this annual equation to work on an hourly basis. So the basic equation is exactly the same. You divide the adjusted recovery load by the load dependent energy factor, but you do this separately for each hour of the year. So it's a summation from midnight, January 1, right through midnight, or 11:00 o'clock, on December 31st.

The recovery load we're going to have to go back to more of a first principles thing, rather than using that regression equation. So it would be the distribution system multiplier times the gallons of consumption for that hour, times the Delta T, times this constant which represents the energy required to lift a gallon of water one degree.

And then the load dependent energy factor equation is exactly, it's pretty much the same equation as before, except this term inside the bracket, inside the log brackets, is adjusted to be the same kind of ratio it was on an annual basis. So instead of dividing -- instead of dividing, but multiplying by a hundred and dividing by 365 days, it's just multiplied times 24. So that's really the only difference.

Next slide, please. These are the coefficients, and these would remain unchanged.

These are now published in the ACM manual.

Next slide. These are the current distribution system multipliers. These are being revised, actually, by Davis Energy Group, on another project related to this. These are the ones that are currently published.

Next slide, please.

MR. DeLAURA: Charles, Lance DeLaura. Just a question. The coefficients you said are not being addressed, or being kept constant. What is the rationale there?

MR. ELEY: There's nothing that we're changing that would cause us to have to take another look at them.

MR. DeLAURA: It's a flat-out --

MR. ELEY: They were -- those coefficients were developed by comparing, by looking at a detailed hourly water model, water heating model, and finding a way to adjust the energy factor. And we're not really changing any of that.

We do need to develop some hourly loads, and we're not proposing to change the basic assumptions that were required of the '92 and the '95, or the '98 standards. This graph shows the relationship between gallons of consumption and conditioned floor area, and as you can see it's very linear, so we'll just work backwards from this and translate, instead of having an -- we will come up with daily consumption in gallons per day that's completely consistent with the CFA rules.

Next slide. One of the things that we need to come to grips with, and we haven't really resolved this one yet, is we've -- it's important that we develop some type of schedule for hot water consumption. In residences, there is a peak in the morning, when everyone gets up, takes their showers, and gets out of the house. Then there's another sort of lower peak in the early evening, when people come home and prepare their dinners. And, you know, this is -- the general shape of this curve, we all kind of know it shows up in the utilities' load curves, and everywhere else. We need to kind of standardize this, though, and put it into the ACM manual.

Next slide, please. These are some graphs that we developed from a project Jim Lutz did at Lawrence Berkeley Lab, which was based on some data from EPRI, and these are just some --

they have sort of the same general shape curve, but are sort of simplified.

So that's basically what we plan to do. It's a very straightforward translation of the load dependent energy factor method into an hourly calculation procedure.

Next slide, please. The next thing I'm going to talk about are the non-residential equipment performance curves. Next slide. Next slide.

We, as Bruce mentioned, in the non-residential realm we've been dealing with part load efficiencies and temperature dependencies all along. But what we want to do as part of TDV is to improve the way we're dealing with it a little bit. Within DOE 2 there's five curves that explain the performance of a piece of equipment at any hour. The first curve is COOL-CAP-FT. It takes account of wet bulb across the evaporator coil, and outside dry bulb temperature, and makes an adjustment on cooling capacity.

The next curve is COOL-EIR-FT. This takes those same two temperature parameters and makes an adjustment on the efficiency of the equipment. The third one takes the part load ratio of the equipment at a particular hour, and it makes -- and makes an adjustment on the efficiency of the equipment.

And then, for heat pumps, there's two parallel curves to the COOL-CAP-FT and COOL-EIR-FT. And those take dry bulb temperature and makes an adjustment on capacity, and in dry bulb temperature, and makes an adjustment on efficiency. In DOE 2, efficiency is -- it's expressed as EIR, which is an Energy Input Ratio. It's essentially the reciprocal of efficiency.

Next slide, please. Next slide, please. What we did in this study is we looked at about 150 different products from various manufacturers, and we developed two sets of curves in addition to the default curve that's in DOE 2. So we have the default curve in DOE 2, we have what we call our best fir curve, which is taking all the data for a class of equipment and fitting a curve through it as best we can. And then we have what we call the P15 curves, and these, this is the average of the lowest performing, the lowest 15 percentile of performing equipment. So we calculated those three.

Next slide, please. So what we're

recommending as a change to the ACM manual is that a compliance user, an architect, engineer, energy analyst, if they choose, they can enter the performance of their particular machine. In commercial packaged equipment the manufacturers publish the capacity and the energy input at other temperatures besides the 95 degrees that's used for the ARI test conditions. The data is generally produced at 85 degrees, 105, 115, 125, and sometimes 135.

So one option would be for -- to enter that data, and the -- then the compliance tools would calculate a temperature dependent curve based on those data, and that would be used in the compliance process. The referenced building would use the best fit performance curves that were developed from that, so this would give you some credit if you had a machine that performed better at high temperatures.

If you choose not to enter the data for your particular machine, then we're suggesting that the P-15 performance curves would be the default. So this would make it a little bit more difficult to comply if you don't enter your own data, because the referenced building would have the best fit curves, and the defaults for your proposed design would be the P-15 curves, the poorly performing curves. So you'd have to make up for that somewhere else in the compliance process.

Next slide, please. I think I can probably skip through these. This just shows -- next slide, please. These are the DOE 2 defaults. Next slide, please. And these show the DOE 2 defaults, and you can see the P-15 curve and how it diverges. This point right here, at a 67 degree entering wet bulb and a 95 degree dry bulb, is the ARI rated conditions. So all the curves cross at that point. And then, depending on where you are in the system operation, your performance and capacity would be adjusted up or down.

Next slide.

MR. AHMED: Excuse me, Charles. Before you go on. What is the dotted line there, again?

MR. ELEY: Well, there's three sets of curves. This --

MR. AHMED: Right.

MR. ELEY: -- this is really a three dimensional plot, if you will. You've got entering wet bulb on one axis, outside dry bulb on the other axis, and on the third dimension is the multiplier on either the capacity of the equipment or the efficiency of the equipment. What we've done here is we've tried to simplify it into just a single dimension graph. So the ones at the top are for a wet bulb of 72, the ones in the middle are for a wet bulb of 67, which is the ARI test conditions, and the ones at the bottom are for 62 degree wet bulb, which is what Bruce was recommending for residences.

MR. AHMED: Yeah, I got that. What I was trying to understand is there is a solid line and a dotted line for each wet bulb. What is the solid line and what is --

MR. ELEY: Well, there's three curves, actually, for each of these. There's the DOE 2 default. There's the best fit curve, which is -- it's very faint there, you really can't see it. And then the bottom curve is the P-15 curve.

MR. AHMED: Oh, okay.

MR. ELEY: The best fit is not visible. The best fit, unfortunately, it's invisible on this graph up there. You might be able to see it over there, slightly.

MR. AHMED: No, I can't.

MR. ELEY: And maybe in your -- sorry about that. It's gone completely. Okay. Well, it's between the default curve and the P-15 curve. I can tell you that. Sorry about that. It's the old invisible curve trick.

(Laughter.)

MR. ELEY: Next slide, please. Let's go on to schedules. Keep going. These just show some of the other curves and how they deviate. Next slide, please.

So basically, we're recommending that we change the ACM manual, and that we quit using the DOE 2 default curves, and we substitute in their place this best fit average curve, which deviates a little bit from the DOE 2 default curves. The standards would -- or the ACM would also publish the coefficients for the P-15 curve, which would be the default for cases when you don't enter your data. And this would be all set up in the ACM manual. It would be pretty invisible to the user, except that when you specify the performance of your equipment you would have to enter more than just the performance at the ARI test conditions; you would enter the performance on both sides of those test conditions.

Now, I will comment, one of the curves makes an adjustment for part load ratio, and we have been unable to get any data on that, so we're not suggesting any change at all on part load ratio curves. It's very tricky and expensive to generate that kind of data, and if the manufacturers have it, they haven't shared it with us. So, and I'm not sure they have it.

MR. DeLAURA: Charles, Lance DeLaura with SoCalGas. You had mentioned that there was going to be credit given for point of use water heaters. My question is, will there be any negative impact to standard storage water heaters in the calculation?

MR. ELEY: I'd like to defer that one to April 23rd, when Davis Energy Group is going to present their analysis on distribution system multipliers. That's really not part of this work.

MR. DeLAURA: Okay. Very good. And a follow-up question, and that is will there be examples of a TDV water heater calculations discussed this afternoon?

MR. ELEY: I believe so. You've got some -- it's actually pretty neutral, you know. It doesn't make a big difference, because water heating energy use, unlike, say, air conditioning, is not quite as peaky, so it's not as big a deal.

Next slide.

MR. AHMED: Charles, I have a question before you go on to the --

MR. ELEY: Yes.

MR. AHMED: On the DOE input, not all three graphs or pairs of points need to be inputted; right? In current compliance runs, you don't have to put in our load performance data.

MR. ELEY: No, it's a compliance run to -- you enter just the EER, the ARI conditions.

MR. AHMED: That's what I thought. Yeah.

MR. ELEY: And the DOE 2 default curves are used for both your proposed design and the reference design.

MR. AHMED: And you're suggesting that under the new methodology, we will have to enter at least two of the three, because the part load data is not available.

MR. ELEY: Well, no. You can still enter just the data you do now, but if you do that your proposed design would use the P-15 curves, and you would lose some credit.

MR. AHMED: Right. Yeah, there will be a difference there. Okay.

MR. ELEY: One other -- next slide, please. Another issue to address are schedules. With the non-residential standards, there are just two sets of schedules. There are daytime schedules, which are used for offices and retail and schools, and so forth. And there are 24-hour schedules, which are used for hotels, patient rooms in hospitals, facilities that are operating 24 hours.

Next slide. What we're suggesting to kind of take advantage, I guess, of the opportunities from TDV, are to -- we're suggesting that we'll continue to use these standard daytime and 24-hour schedules for all of the life cycle cost work, and these schedules would continue to be a default. Lots of times when we use -- when we do compliance calculations, it's -- if it's a tilt-up concrete building, a flex building, you don't really know if it's an office or a retail, or a restaurant. And when it's not known you would use these defaults.

However, we're suggesting that when you know that it's an office or retail or a school or an assembly, one of those four spaces, that you would have the option of using that more specific schedule to do your analysis. And, of course, you would have to use that same schedule for both the proposed design and the referenced building, so there's no credit for changing schedules. It's just we think it would give a more fair trade-off, and would be -- and would take advantage of power TDV.

These alternate schedules have been developed based on the non-res new construction database. This is a database that's been supported by the utilities. It includes 990 non-residential buildings. I believe there's about 220 offices in that dataset. Something like 160 schools, 160 retail stores, and I don't remember how many assemblies. But it's -- next slide, please.

So these graphs compare the -- again, you have to kind of use your imagination, but these square curves here are the -- that is the curve for -- that is the 24-hour daytime schedule for weekdays. This is the 24-hour daytime schedule for weekends and holidays. This curve is the curve from the non-res new construction database for offices. Here's for schools, this -- that one is -- is that retail? And then, and this is assembly. So you can see that there's really quite a lot of difference between these building types, and if you know that it's going to be a school, or if you know it's going to be a retail or an office, and often we do, then we're suggesting that these other -- that these alternate schedules may be used.

This shows -- the next slide -- similar pattern for equipment. Next slide. This is fan operation, which is essentially HVAC operation. Next slide. Cooling temperatures. Next slide. Heating temperatures.

So these are all, this data is all summarized in the more detailed report, with graphs large enough to read.

Thank you.

MR. ALCORN: Thank you, Charles.

We're just a little over on our time. We're going to go on ahead and break for lunch now, and resume at 1:10, which is a 45-minute lunch.

So I would like to remind those of you that, if you haven't had a chance to sign in, please do so during our lunch break. Thanks very much.

(Thereupon, the lunch recess was taken.)

AFTERNOON SESSION

MR. ALCORN: Thank you. Before we went to lunch we were discussing the Time Dependent Valuation engineering analysis, and I didn't invite questions at that time, and I'd like to invite questions now, to Charles Eley and Doug Mahone, on the three subjects that they addressed in their analysis.

Sorry, Bruce.

MR. WILCOX: All my questions should go to Doug Mahone.

MR. ALCORN: Okay.

MR. AHMED: A.Y Ahmed, consultant for Southern California Gas.

I have a couple of questions that -- on Bruce's presentation, regarding the heat pump.

MR. WILCOX: Yes.

MR. AHMED: As far as the -- you mentioned the DOE hourly model, it will be incorporated into Micropas; right?

MR. WILCOX: Right.

MR. AHMED: And will it incorporate auxiliary heat and other ancillary electric use like a crankcase heater and defrost cycle, and et cetera?

MR. WILCOX: We plan to use the DOE 2.1E model pretty much straight. And so what the crankcase -- or, the defrost is included in the curves that relate performance to temperature. And so that's handled at the level our model is able to do it. And the -- we're going to assume that the loads are all met in the hour that they occur, and that if the compressor capacity is not big enough, that it's followed up back up resistancy in that hour. So that'll be fully accounted for.

We're not planning to do anything with crankcase heaters at this point.

MR. AHMED: Because the crankcase heater is not included in the EER or the ACOP, or the COP.

MR. WILCOX: Well, yeah, a very long history of that, on that subject. But the -- we're not planning to do anything special with crankcase heaters at this point.

MR. AHMED: Now, as far as when you tie this with sizing, it could -- the auxiliary electric heating could become a significant part, so I hope you will take those things into consideration when we go into the sizing issue.

MR. WILCOX: I expect that it will become a significant part. That's part of the intention.

MR. AHMED: Okay.

MR. ALCORN: Are there anymore questions or comments? Okay.

MR. DeLAURA: Bryan, I just had a quick comment, not related to this subject, but for SoCalGas and San Diego Gas and Electric. Again, I apologize for my voice here.

I wanted to let folks know that this is actually my last day representing SoCalGas in this capacity. I'm taking on some new responsibilities for San Diego Gas and Electric, as well as SoCalGas, managing our energy conservation programs. So there is a group of folks here -- yes.

(Laughter.)

MR. WILCOX: Well, I didn't plan to elaborate at all on that.

MR. DeLAURA: I wanted to introduce a couple of folks here. Daryl Hosler, could you stand up. And also, Kurt Kaufman. And also Ron Caudle. Between these three gentlemen, they will be representing these separate energy regulated utilities.

MR. ALCORN: Great.

MR. DeLAURA: It's been a great pleasure working with the Commission. I have enjoyed it.

MR. ALCORN: The feeling is mutual.

MR. DeLAURA: Anyway, thanks for a great experience.

MR. ALCORN: Thank you, Lance.

Okay. We'll go on ahead and move to the next topic, which is TDV Methodology. And I guess Doug'll start off.

MR. MAHONE: I guess I'll have to postpone my nap. Hopefully, I won't be encouraging the rest of you to not postpone your nap.

Well, so we've been talking broadly about the concept of TDV and how it was derived, and some of the engineering calculation details. But really, the bottom line is what does it do to compliance. And so I'd like to turn our attention now to that.

We've done a series of parametric analysis exercises here, for both residential and non-residential buildings, to try to illustrate what the bottom line for compliance is under TDV, compared to how compliance works out under the old source energy valuation.

So for -- we did these analyses using annual simulations of some sample buildings using the residential compliance tool Micropas, and the non-residential compliance tool of Energy Probe. And as I said earlier, what these programs are doing internally is they're calculating an hourly energy savings for each of the fuels, they're calculating the difference between the proposed design and the standard design to get the hourly savings, and then multiplying the hourly savings by each of the hourly TDV factors that we've developed, adding those up over the course of a year. So what you end up with is a comparison of the base case, or, to be more precise, the standard case to the proposed case.

Next slide. So I'm going to be showing you a bunch of graphs, and I'll explain to you how to read them because they're kind of information rich, information rich graphs. But what they're going to be doing is they're comparing the compliance margin as calculated under the source energy valuation, with the compliance margin calculated under the TDV energy valuation.

Next slide. So each one of these will be reported as a percent savings, and what I mean by percent savings is that it's the total source energy, or total TDV energy divided by -- for the proposed design, divided by the corresponding source, or TDV energy for the standard.

So when it says six percent, that means that the proposed design uses six percent less source energy, or six percent less TDV energy than the standard design. And this is the way the compliance community thinks of compliance, you know, how much better than Title 24 am I. So this gives us a way to directly compare a bunch of different measures.

MR. FERNSTROM: Question, Doug. Gary Fernstrom, PG&E.

Does, in your example, would it be six percent less energy at that point in time, or annualized, or --

MR. MAHONE: These are all annual savings numbers.

MR. FERNSTROM: Thank you.

MR. MAHONE: Okay. So let's turn to the residential analysis, which is the next graph. For the residential analysis, in the report that I was waving around earlier, we report the results for four sample houses. These were provided thanks to Rob Hammon, from ConSol, as houses that are representative of current designs that homebuilders in California are putting out. And we've got a small house, a little under 1300 square feet, single story, with about 16 and a half percent glazing. We've got a medium house, a little under 2200 square feet, two story house with 20 percent glazing. We've got a large house -- I don't know about you, but I'm not rich enough for this house -- almost 3300 square feet, two stories, 25.8 percent glazing. And then we have a two story townhouse, a little under 1700 square feet, with a little under 19 percent glazing.

We started out with a base configuration for each of these, which is as that house would currently be built, to comply with current Title 24. Most of these houses are actually a little bit better than Title 24, and their base configuration, which is also kind of the way a lot of builders would build them. We also did this analysis for four different climate zones, Climate Zone 6, which is Long Beach; Climate Zone 12, which is Sacramento; Climate Zone 13 is Fresno;

and Climate Zone 14, is the high desert area, like Victorville and Apple Valley, down in southern California.

Next. We looked at 24 different measures, and these break down into window measures, the first three are window measures, where we varied the U factor and the solar heat gain coefficient, solar heat gain factor. We have two radiant barrier measures, one with no radiant barrier, one with a radiant barrier. We have three different levels of ceiling insulation, three different levels of wall insulation. We have an air conditioner variation with a thermal expansion valve. We have two different SEER ratings for air conditioners. We have a higher efficiency furnace. We have two levels of duct insulation. We have two standards of duct tightness. We have two different water heater configurations. We have a water heating pipe insulation, and then the final two we did variations plus or minus ten percent on the glazing area for the base -- compared to the base configuration.

So let's take a look at the first graph. As I said, these are information rich, which is another way of apologizing for them being a little hard to understand. But I think if you spend a minute getting familiar with how they work, you'll find that this is a very useful way to compare a lot of variations to each other.

So for starters, we'll take a look at the vertical axis labeling, which is percentage of compliance. So if you have, for example, this first red bar where the percentage of compliance is probably about seven percent, that means that the house has a TDV energy use that's about seven percent better, or seven percent lower than the standard design for that house.

The next thing you should know is that there's two series here. There's the blue series, which is how the compliance margin would be calculated under the current regime, under the current source energy, and then the red bars are how that same house compliance margin would be calculated if you were using Time Dependent Valuation saving.

So in the base configuration for this large house, in Climate Zone 14, under current regime it has about a four percent -- I'm sorry, that's about a two percent compliance margin.

It's just a little bit better than Title 24. If you took that same set of measures for that same design, in the same location, under TDV the compliance margin is about seven percent. Same exact building, it's just that for the measures in this house they are somewhat more highly valued by TDV than they are under source energy.

MR. AHMED: Excuse me, Doug.

MR. MAHONE: Yes.

MR. AHMED: Before you go on. Just to understand the base home.

MR. MAHONE: Yes.

MR. AHMED: What does it have?

MR. MAHONE: The base home --

MR. AHMED: Does it have a gas furnace?

MR. MAHONE: Let me get the details out of the report. There's the report.

If you look in the full report, the description of the base house is found on page 20 or 21. So the large house in this -- okay, I'll just kind of summarize it briefly. There's a, as I said, the total glazing area is about 26 percent of the floor area. Of that, the breakdown of north, south, east, and west is shown on page 21 here, fairly typical home breakdown. It has a gas water heater with a 75 gallon storage tank, and an energy factor of six. Has a gas furnace with an annual fuel utilization efficiency of 50 percent -- I'm sorry, this is still the water heater. The AFUE is 50 percent, and it has a recirculation system. It has a gas furnace and a SEER 12 air conditioner.

And then, depending on what climate zone it is, it meets the current requirements for solar heat gain.

MR. AHMED: Thank you.

MR. MAHONE: Okay. So, anyway, that's the basic details.

Now, one of the other things -- well, so I've showed you how to read the basic bars, in terms of the blues are the source energy, the reds are the TDV energy, and in some cases the compliance margin is better with TDV; other cases, it's not.

But what, if you then start comparing from one measure to the other, you can sort of mentally go through the same kind of trade-off exercise that a compliance analyst would do, or a builder would do, in trying to decide what measures they wanted to do.

So, for example, the next set of bars over from the left represent a decrease in the performance of the glazing, compared to the base case performance for the glazing. And when you reduce the glazing performance, and in this case the source energy compliance margin goes negative, and it goes down to about 16 or 17 percent negative, under TDV it doesn't go quite as negative. It's more like 12 or 13 percent negative.

So if the builder chose to downgrade the glass to this lower performance, they would have to make up that same amount of compliance by picking some other measures that were positive, that would offset the negative. And so by comparing across from one measure to the other, you can get a sense of where the big ticket items are.

The next, the biggest positive one on this graph is the fourth one over, which is basically an improvement to the glazing performance over the base case. So, you know, that's kind -- these first three sort of illustrate the range of pluses of minuses for compliance that you would get from glazing, and those are fairly big.

If I switch to the next graph, we can see there's a number of larger compliance margin items, and the first one that you see on the left there is improving the SEER performance. And you can see that if you improve the SEER rating for the unit, you get about a six or seven percent positive compliance on your source energy. TDV values air conditioning performance more highly, because it's a highly peak coincident kind of a load, and so you get a much bigger compliance margin by improving the air conditioning performance.

So I don't think we've got time to go through all the comparisons here, but does anybody have any questions about how you read these graphs and sort of how you do the comparisons?

Yeah, Rob.

MR. HAMMON: Rob Hammon, from ConSol. If I could make just a clarification statement.

Doug, you said this, but I'm not sure it's going to be clear to everybody. When I went through these charts, these homes that are being analyzed are, as Doug said, homes that are actually being built with the set of features that are described in the home descriptions. Those are not package features. So these homes do not reflect simply the standards, but homes that are being built to meet the standards, the current 2001 standards using a variety of features that are representative of the market.

If you -- could you go back one slide. If you look at the base, you can see there's a disparity in this house, and in some of the other houses it's much, much larger, between the base case, the far left, for source and TDV. And if you go through the charts with these homes, you might come to the erroneous conclusion that TDV weakens the standards, because in most of the cases the TDV base complies more than the base case, the source case.

The reason it does that is because these homes happen to have features that favor cooling. And so there's a systematic difference between the two cases, the TDV case and the base case, the source case, that's kind of built in to these homes.

We asked Doug to do this using real homes. And he has done this same experiment with the CEC 1761 house, and package features. And in that case, this systematic difference goes away. And I think that's really important for everybody to understand.

MR. MAHONE: Yeah. Thanks, Rob, that's a good --

MR. AHMED: I have a question, Doug. These runs that were done, does it include the changes that Bruce and Charles proposed for water heating, and the part load curves for air conditioners, or this is based on without those features?

MR. MAHONE: This does include the engineering enhancements, so there's an hourly equipment model in the TDV runs, and there's the hourly water heating in the TDV runs, as well.

MR. AHMED: So that has been incorporated.

MR. MAHONE: So that's incorporated here, as well.

So the source energy runs are done using the current Micropas, which does not include these -- equipment model enhancements. So part of the difference you're seeing here is also an engineering algorithm difference.

MR. AHMED: Okay. So that's been

incorporated.

MR. MAHONE: That's incorporated, yes.

MR. AHMED: Now, referring to Rob Hammon's comment that these were actual homes.

MR. MAHONE: Yes.

MR. AHMED: What was the margin for the base case home that is used to develop the standards, like a 1760 square foot home? Is the TDV margin as high or does it require that the standard has to be raised, or, you know, typically what it should be is it should be zero margin; right? If it's at the standard, it is meeting the standard.

MR. MAHONE: It just means the standard -- the base, the house that we started with had a compliance margin of about two percent. It was about two percent --

MR. AHMED: All right. But this is a house that is being built. I'm talking about that hypothetical house that is used to set the standards.

MR. ELEY: It would be zero.

MR. AHMED: It should be zero.

MR. ELEY: Yes, it would be.

MR. MAHONE: By definition it would be

zero.

MR. AHMED: Right. But the house that's -- that is currently in the standards, will it come up with a margin with the TDV -- that's my question.

MR. ELEY: Sure. Yeah.

MR. AHMED: And how high is the margin?

MR. ELEY: It would be zero.

MR. AHMED: It should be zero.

MR. ELEY: It will be.

MR. AHMED: Okay.

MR. ELEY: This only comes to play if you start making trades.

MR. AHMED: Right. Okay, I just wanted to understand that.

MR. ALCORN: Okay. We need to -- actually I've got a request from Commissioner Pernell's office to do a connection so that he can listen in to the workshop upstairs, so we need to stop and turn off the Power Point presentation for one or two minutes. And then we'll resume.

(Off the record.)

MR. WARE: I think that was my question, Dave. We're on 20. If you look at the base case building, and you did TDV on the base case features, would there be any difference in -- I mean, would you have one chart higher than the other? Or --

MR. MAHONE: Not at the -- not for the base.

MR. WARE: Not for the base.

MR. MAHONE: Not for the base. And different measures would respond differently, between TDVA and --

MR. WARE: Okay. Okay.

MR. MAHONE: So, yeah. The basic, I mean, the basic conclusion here is that measures that are highly peak coincident score higher or score lower under TDV than they do under source. And measures that don't, pretty much score the same. And there's a few measures that are very off peak, like economizer cooling, for example, that actually scores worse under TDV than under source.

Are we back online yet?

MR. ALCORN: I don't think so.

MR. SCHWARTZ: We're still open for questions, aren't we?

MR. ALCORN: No.

MR. SCHWARTZ: Peter Schwartz. Back to

the base house, it's not intuitively obvious to me that there would be no percentage differential between the current standard calculation and the TDV, because there could well be in the base house a feature inherent in it that would be better represented or penalized in TDV. So I'm not sure I believe your answer.

MR. MAHONE: It's a definition thing. The base house, by definition, has their compliance margin.

MR. SCHWARTZ: Well, right, for -- under current things, but not necessarily under TDV.

MR. MAHONE: No, it's the same definition.

MR. SCHWARTZ: Is it?

(Parties speaking simultaneously.)

MR. SCHWARTZ: All right. The actual question I had, did you do a run that put together a package of best practice, to see what the margin would be, rather than individual parametric runs? Did you actually do a package that would show this is best practices for these various models?

MR. MAHONE: No, we did not do that. We sort of took the base configuration that ConSol gave us -- well, not the best practice, but current practice, typical practice, yeah. They call it best practice. So we took that package, which isn't the same as the prescriptive packages. It was a choice of measures that some builder picked as being a good choice for what they thought would be buildable under the current scenario.

Then we said, okay, you know, what would you -- what if you took something out, what if you added something in, and we ran a whole bunch of those single take out or add in kind of parametrics and just set them up side by side, so you can kind of mentally put together a package yourself by, you know, you take a bar that's plus three, and a bar that's plus six, and you can trade there off a bar that's minus nine. So that package of three should still come out about even.

MR. SCHWARTZ: Yeah. I just thought it might be good for the marketplace to see what a best practice package looked like.

And the other question I had is did you do a boundary condition analysis, for instance, taking one of these new mega-homes and plugging it in to see what impact there is, or the other boundary condition might be taking an existing home that's getting an addition put on, so you kind of see what the margins look like, rather than kind of the mainstream market?

MR. MAHONE: We didn't do that, although the large home case here, which is actually the one we're looking at, is almost 3300 square feet with almost 26 percent glazing, so it's a pretty high, that's pretty, I don't know how extreme it is, but it's a pretty high end project. It's one of the projects that's kind of a challenge to the builders to make it comply.

MR. SCHWARTZ: I was thinking some of the -- well, obviously, in Marin there's, you know, a lot of custom homes where, you know, 3200 square feet is small. You know, I just wonder how these homes get built under the standards, so that's why I asked that question.

MR. MAHONE: I'm not sure we ought to devise a whole Title 24 standards for George Lucas, but --

MR. ALCORN: Okay. Thank you, Peter.

Ken.

MR. NITTLER: Ken Nittler, with EnerComp. Just a couple of comments. To respond first to Peter, the idea of doing, looking at a number of features at once. That type of analysis will be coming in the not too distant future.

When you look at cooling, what this study shows is one thing. It shows what the 2001 standards look like, if you add the TDV engineering assumptions on top of it. And the --

MR. MAHONE: The hourly valuation.

MR. NITTLER: Right. The TDV stuff. And what I want to add on is in a little while here you'll hear Bruce talk about some other modeling changes, so there's some other things that are going to be loaded on top of that change as well, potentially.

The third thing I want to say is I want to talk about cooling budgets. And this sort of goes back partly to what Peter's saying, and maybe a little big of what Rob was just asking about. Cooling budgets -- heating budgets are roughly the same under this new valuation scheme. Typically, well, basically the same. Cooling budgets, though, can be two or three times bigger than what they used to be. So if under the 2001 valuation for a particular house you had a cooling budget of ten, it might show up as a cooling budget of 20.

MR. MATTINSON: On both sides?

MR. NITTLER: On both sides. Both standard and proposed. So if we looked at Peter's question maybe a little bit, this just shows the percent difference, but if instead you looked at the magnitude of the energy, then you would've seen the different valuation and it -- well, it would've looked different. But if you -- it would be more apparent what the different valuation is now. I don't know if that helps.

MR. AHMED: Excuse me, Ken. Are you saying that the cooling budget will actually increase under TDV?

MR. NITTLER: Let's do an example. If you have a source energy under the current standards, and I'm going to make some number up here, in Climate Zone 14. Source on heating might be five in Climate Zone 14. The cooling budget might be 25. And I'm saying under the new stuff, valued with TDV and all these modeling changes, the heating budget probably remains around five, but the cooling budget doubles.

MR. HAMMON: But those are different units, are they not?

MR. MAHONE: Well, those are TDV energy units compared to source energy units.

MR. AHMED: That was going to be my next question, that you really cannot compare the light blue and the dark blue, because one is a source energy KBtu, the other one is TDV energy. But they are not exactly the same thing.

MR. MAHONE: No, they're not exactly the same thing.

MR. AHMED: One is a pseudo Btu, and the other one is the real Btu.

MR. MAHONE: Right. And that's why we chose to express this as a compliance margin as a percentage, because the difference in units isn't as significant. And really, from the bottom line point of view, if somebody's trying to get a house designed to pass Title 24, you want to know what the compliance margin is. And if you're trading off different measures, some measures reduce your compliance margin and some measures increase your compliance margin.

So that's why we presented it this way. We thought it would be kind of a simpler way for people to understand it without getting wrapped around the axle about what the difference is there.

MR. AHMED: It's excellent for

comparison purposes.

MR. MAHONE: Yeah. But to Ken's point, under the source energy valuation, electricity was valued on a Btu for Btu basis, with a factor three times greater than fuel. When you look at the actual costs, which is what TDV is based on, on an annual basis electricity is more like four, five, sometimes six times higher value compared to natural gas. Which is why what Ken was saying happens. The cooling energy budget, when you have a very, you know, a peak dependent load like air conditioning, does end up with a higher valuation, because that's the way the real world is.

So let me move on to the next graph, which is the Min/Max -- the next one after that -- Min/Max comparisons. This one is even more information rich, to continue with my euphemism, than the previous ones. But as you know, under residential compliance there's what we call the cardinal orientation option, which is you can take any house design and make -- and you can build it facing any direction provided you model it under the four cardinal orientations, and show that even under the worst of these orientations, that that house will meet Title 24.

What this is doing is comparing site energy and TDV -- I'm sorry, source energy and TDV energy for two different cases. The left two bars are for the minimum compliance margin, and the right two bars are for the -- or do I have this backwards. I'm sorry, the left two are source energy, the right two are TDV energy. The lower ones in both cases are the minimum compliance margin, doing a cardinal orientation, and the taller ones, which are the right-hand ones in each one of those pairs, are the maximum compliance margin.

So we're basically picking two of the four runs and setting them up side by side here, and showing site versus -- sorry, I keep doing that -- source energy versus TDV energy.

What you can see in general is that the TDV bars are a little bit more extreme than the source bars for the minimum case. And the reason for that is that TDV, because it places higher value on the peak cooling kind of conditions, is going to be more sensitive to building orientation. So if you've got a house that has a lot of the glass facing just one orientation, when it's at that worst orientation, probably facing west, it's going to experience higher cooling loads, and TDV is going to recognize that.

MR. PENNINGTON: Doug, could you walk us through one of these? I'm having trouble understanding. What's zero? I don't -- first off, I'm not sure I understand what zero is.

MR. MAHONE: Okay. The first set of bars is the base house, as it currently exists. So the left-hand, the blue one is the source energy compliance margin for the minimum orientation. And the comparable one is the red one, which is the TDV valuation for the minimum orientation.

So for this base house, in the worst orientation the minimum compliance margin is about two percent under source energy valuation. This same design actually fails with about a negative three percent compliance margin under TDV.

MR. ELEY: So the only thing that's varying here is orientation.

MR. MAHONE: Right. This is orientation.

MR. PENNINGTON: So what is zero? Zero is the --

MR. MAHONE: Zero means it just meets Title 24 with no compliance -- with no margin.

MR. PENNINGTON: The reference house --

MR. MAHONE: The reference house equals the standard house. I mean, the proposed design meets the standard design.

MR. ELEY: So this base case applies in all orientations.

MR. PENNINGTON: I'm sorry. With equal distribution of glass on all orientations?

MR. MAHONE: No, this is not equal -- this is one of the sample houses.

(Parties speaking simultaneously.)

MR. ELEY: The zero case --

MR. PENNINGTON: That's what I'm saying. We're talking about what is zero. And I'm trying to figure out what zero is.

MR. WILCOX: Zero is equal orientation.

MR. MAHONE: Oh, I'm sorry. Yeah. The standard design against which the proposed design is compared has equal orientation. Or equal glazing.

MR. ELEY: But not the same package. These are the ConSol houses here. So it's not just orientation that gets equalized. There are a lot of other measures that are different, getting to zero.

MR. PENNINGTON: So zero is the Package D house, with equal distribution of glass.

MR. ELEY: Right.

MR. MAHONE: Well, or in this case, the base configuration house has the same energy use as the Package D house with equal glazing orientation.

MR. ELEY: And that, if I understand, that first bar is showing that the best orientation of the ConSol house has a one percent compliance margin. And the worst orientation of the ConSol house has a five and a half percent compliance margin. Is that right?

MR. McHUGH: The worst has a compliance margin of about two percent.

MR. ELEY: Well, it would be --

MR. MAHONE: Yeah. The worst orientation of the ConSol house has a compliance margin of about two percent. The best orientation of the ConSol house -- let's see, which -- I'm not sure. I got -- which one is which here. It's the next bar, the yellow bar, has a compliance margin of perhaps eight or nine percent. Under source energy valuation. And then you take that same scenario under TDV, and the worst orientation has a negative compliance margin of about three percent, and a positive compliance margin of about seven percent.

MR. PENNINGTON: So another way to say it would be that for this house configuration, using the multiple orientation alternative that the builders, production builders use, you would be going from a situation where you comply with a little bit of a margin to a non-complying situation, and you'd have to do something more to that house to comply.

MR. MAHONE: Right. You'd have to do something more to the house to make it --

MR. PENNINGTON: Well, that's -- what defines the standard.

MR. WILCOX: Such as adding R8 insulation on the ducts, or some of these other measures that are --

MR. MAHONE: Yeah. So let's kind of continue that. If you had, if you start out with --

MR. MATTINSON: This is the house with 26 percent glass?

MR. MAHONE: Yes.

MR. MATTINSON: Does this show up in the

report, where we might see it a little larger? Page 28? Thank you.

MR. MAHONE: Yeah. So just looking at things that you -- let's just take the red bars and look at what you can do to make up for this negative compliance margin of about three percent under TDV. You could make up for a good chunk of that over here by improving the glazing down to a U factor of .35 and a shading coefficient, or a heat gain coefficient of .35. You could make up another percent or so by putting in R-8 ducts. You could also make up another few percent by reducing the glass area by ten percent.

Yes, Rob.

MR. HAMMON: I'm confused on this, because in the initial graph that you have for this house, you have -- it's like you're comparing, in the initial one, the blue and the green. And now, did the worst case change?

MR. MAHONE: I actually don't have a good answer for that. I'm going to have to look into that.

MR. HAMMON: Because it looks as though it did. I mean, I'm assuming that in your original graphs that say "min", the green graph is the same height as three slides back, I think. And the red is now as if it's a new worst case.

MR. MAHONE: Yeah.

MR. McHUGH: I think we have to revisit this, and we'll submit it an addendum.

MR. HAMMON: Okay.

(Parties speaking simultaneously.)

MR. MAHONE: -- didn't have time to find the answer to it.

MR. PENNINGTON: Can you say what charts you're looking at, just so I understand what --

MR. HAMMON: They're in the appendices, Bill. Can you go back a few slides? There.

MR. PENNINGTON: I have the charts.

MR. HAMMON: See on the far left, Bill, you've got the blue and the red?

MR. PENNINGTON: Yeah.

MR. HAMMON: And the red, I think, is what we originally had as the worst case orientation for that house. I'm guessing. I don't know that. But in that case, it's seven percent over complying.

Now, go forward two slides. Now, all of a sudden, the red, as if it's out of nowhere, from my perspective.

MR. PENNINGTON: It's similar to the green. And maybe that's why you said --

MR. HAMMON: Correct. I'm thinking that the green is what was originally the worst case orientation, and now, looking at things again, the worst case orientation may have shifted. I don't know that. I'm speculating. But there's something going on between these two slides that I do not understand.

MR. MAHONE: Yeah. And I apologize for that. We're a little confused on that point ourselves, so we'll figure that out and let you know.

MR. PENNINGTON: Yeah, Bruce. It looks like you charted the blue versus the green in the previous chart.

MR. MAEDA: Doug, Bruce Maeda, CEC Staff. I had a question about your glass minus ten percent. Is that minus ten percentage points, like say 26.8 down to 16.8, or is it .9 percent times the glass area, the second one?

MR. MAHONE: It's the latter.

MR. HAMMON: One other clarification. I assume that your scale, your percentage scale is mis-marked. Did that --

MR. MAHONE: Yeah.

MR. HAMMON: Yeah.

MR. MAHONE: Those are decimal numbers. they should be percentage. So it should be zero percent, five percent, ten percent, fifteen percent, going up.

MR. RAYMER: So like that red, the first red one's about two percent?

MR. MAHONE: Right.

MR. RAYMER: The first -- the blue one.

MR. MAHONE: The first blue one is about two percent there, yeah, not .02 percent. Yeah.

Okay. Well, let's move on to the non-residential analysis. I'm getting nervous looks from people with watches sitting on the other side of the table here. Non-residential never seems to be quite as controversial as residential, so maybe we can go through this a little quicker.

We have an office building, 117,000 square feet, six stories high, built up VAV system. We have a retail building of 50,000 square feet, single story building, with packaged VAV. We looked at six different measures. We looked at what happens if you go from an electric chiller to a gas chiller. We looked at what happens if you improve the efficiency of the air conditioning unit, the EER for the package VAV and the COP for the built up chiller.

We looked at adding an economizer, we looked at adding a cool roof. We looked at reducing the solar heat gain coefficient on the south and west orientations, and we looked at reducing the lighting power density by 20 percent from where it starts out.

Next, please. So we've got two graphs here. And I should point out all of these graphs I'm showing are just subsets. If you go back further in the report, there's pages of these things. Knock yourselves out.

So for the office case, we've got -- well, first of all, reading the graph. We've got the same vertical axis here, which is the compliance margin. We have the same comparison between the blue graph, the blue bars, which is the compliance margin under source energy, versus the red bars, which is the compliance margin under TDV.

The one big difference you'll see looking across these measures is for the gas chiller, and this is because gas is valued a lot lower than electricity, so the cooling energy with a gas chiller is a lot less than the cooling energy with an electric chiller. So there's a big savings there.

Other measures, there's less of a difference. Changing the efficiency of the air conditioning unit has an effect, it's valued more highly under TDV than under source energy, but not by a huge amount. And putting in an economizer, you actually get lower valuation under TDV than you do under source, and that's because the economizer only saves energy during non-peak temperature events.

The cool roof, it looks like a tiny difference here because it's a relatively small fraction of the overall building energy use, but if you compare the absolute value of those two numbers it's -- which you can't really see because it's such a small scale -- but it's almost twice as highly valued under TDV than it is under source energy, because cool roofs are saving energy during the peak hours.

The glazing, reducing the solar heat gain coefficient on the south and the west, again it's more highly valued under TDV. For this particular building they're both fairly small numbers, however, because this building is not terribly dominated by solar heat gains.

And then reducing the lighting power density by 20 percent is slightly more valued under TDV, just because for the office occupancy a lot of that lighting energy use occurs during peak conditions, and so the savings is somewhat more highly valued under TDV.

Switch to retail. Retail, you see basically the same pattern. The gas chiller example is even more dramatic. Here, because it's a 50,000 square foot building, single story, you can see the cool roof effect a little more clearly. There's very little glazing in the building, so the glazing makes almost no difference. There's more lighting power, it's a higher fraction of the total energy use in retail than it is for office, so the delta for the 20 percent reduction in the lighting power density is more dramatic here. The rest of the patterns are pretty much as we talked about.

So, to sum up. Oh, no. Sorry, one more topic. Next slide, please.

Going back just for a minute to this

externality question. We discussed a little bit this morning that externality are part of our proposal. Some questions were raised about whether it's really worth doing an externalities analysis. We think it's worth doing for consistency with the CPUC measure valuation, and also because the Warren-Alquist Act basically says you ought to do it.

But in terms of the bottom line, we've actually found that the externalities, at least as we've characterized them, have very little effect on the final trade-off. They do tend to affect measures on peak more than other measures, but the main effect, if the Commission were to adopt TDV with environmental externalities, would be in calculating the cost effectiveness of measures that are right on the hump between being cost effective or not being cost effective.

For most measures, this would have very little difference, and let me just show you that. Next graph. This is a comparison of -- in this case we're comparing the compliance margin with and without externalities. The green bars on the right of each pair are the TDV valuation with externalities, and the blue bars are TDV valuations without externalities. And without going into any of the details, you can see that the differences are pretty minor.

This is for residential, and the next graph shows the same kind of comparison for some non-residential retail measures. The only noticeable difference really, in this scale, is on the gas chillers, and when you put the environmental externalities into the gas chiller scenario you get a somewhat lower compliance margin, because there are more of an externalities effect on the gas chiller, on the gas consumption.

So, to conclude. Next question. First one, please. Electricity savings measures are more highly valued under TDV than under source valuation, and that goes back to that comment I was saying earlier. The source energy multiplier for electricity is three, the equivalent multiplier on the TDV side is more like four or five.

The difference between the valuation is really indicative of the demand impact of a measure. And since one of our major objectives here is to reduce demand, TDV I think does that correctly.

The next one. For measures that are just gas only measures, they pretty much come out the same whether it's TDV valuation or flat valuation. So it's kind of a neutral difference for gas measures. Under propane, it's the same thing, but if you're comparing propane to natural gas, propane is more expensive than natural gas, and is more highly valued than natural gas. So if you're doing a trade-off between propane and electricity versus a trade-off between natural gas and electricity, you'll see a difference in the outcome because the propane savings will be more highly valued than the natural gas savings. But that's the way it is out in the real world.

This slide is a little bit of an exaggeration when I say winners and losers. I apologize for the dramatic intent here. I don't really want to make it seem like people are going to go limping home. But when I say winners, I'm saying measures that are a little more highly valued by TDV than source energy, and this is pretty much what I've been showing you on the graphs.

Peak air conditioning measures, measures that improve the efficiency of the air conditioner under peak conditions, are more highly valued. Fenestration measures are more directional under TDV than they are under source energy. Gas cooling measures, there it is fair to say they're big winners compared to electric air conditioning sources. Cool roofs do well under TDV, and other kinds of on peak measures also do well.

In terms of losers, propane will have a smaller advantage over electricity under our proposal than they currently do, because propane measures are currently treated as if it was natural gas, which is much cheaper than propane.

Economizers don't do quite as well under TDV, because their savings occur during off peak measures, and that will be true of any off peak measures. However, measures that do their energy savings pretty much across the board, across the timeframe, come out pretty much the same whether it's TDV or source energy. So most of the insulation measures, they save when it's cold, they save when it's hot, they don't really change their weighting in the standings, whether it's TDV or source. And residential water heating is pretty much the same, and for the same reason.

MR. DeLAURA: Excuse me, Doug. I don't

see gas space heating. Where does that fall on the table?

MR. MAHONE: Let's see. Gas space heating, like most gas only measures, pretty much comes out the same whether it's TDV or source.

MR. DeLAURA: That's res and non-res.

MR. MAHONE: Yeah, for residential or non-residential. Where you'll see the difference is when you're doing a cross fuel comparison between a gas furnace and an electric heat pump, for example. But just comparing two different gas furnaces, it's about the same outcome whether it's source or TDV.

So let me just wrap up here with a couple of final concluding slides. Next one. Questions about TDV. Does it appropriately increase the valuation of peak measures, which was one of our primary goals. And I think the answer to that is pretty clearly yes.

Next question, does TDV maintain a similar stringency as the current standards basis? Well, that depends a little bit on which measures, and how they're valued. It is a different valuation scheme, and the prices of energy overall are different now than they were in '92. But, so you can't give an unqualified answer to that question.

The next one, does TDV create any pathological cases; in other words, cases where it's really sending very strange signals out, or very unexpected results, and we haven't found any yet. Any help in finding them would be appreciated, so if it's a problem we can fix it.

The next question, is it possible to gain Time Dependent Valuation in the ACM method. Well, that's, of course, going to depend on how successfully we implement all the details in the ACM, but we've given this a lot of thought and we think the answer will be no, if we do it right.

And are the engineering modeling changes ready? We've already seen, from Bruce and Charles and others, what engineering modeling changes are integral to TDV, and those are mostly ready. There's still a few details that need to be worked out, but we've got the concept worked out, and are working on the details. And those will be resolved during the process of editing the ACM manual and the rules for ACMs, which is kind of further down the road. So they will certainly be ready when that time comes around.

Next. So why make the change, is my final sales pitch here. It helps the economy, we think. It will provide least cost energy design over the long run, both for the individual owner and for the state. It's going to save dollars as a consequence for everybody in California. This isn't -- please don't think this is just because the utility companies like it that it's going to be good just for the utility companies.

We think it sends the right signal to building designers, and for new building design we think this is actually about the only mechanism we've got to do this statewide. There are some voluntary programs, of course, that the utilities have been running, but they're typically only reaching a fraction of the new homes that get designed, and the new non-residential buildings. So we think this is the best way to get signals to designers, and we think it's giving the right signals on costs. After all, an economist developed this method.

So, next slide. Other reasons for making the change. The current way of doing it is clearly wrong. Energy costs are not flat. And so we're truly giving the wrong signals now. So even if TDV were not to be perfect, and I would argue against that assertion, but even if that were true, it's clearly better than what we've got now.

We've got an electricity demand crisis in California -- well, duh. And the compliance process which we're using to do this won't change in any substantial way. We think it's an evolutionary change to the standards. This is not a revolution. If you get all wrapped around the details it looks like it's a lot of changes, but really, as you can see from these compliance results, it's not going to overwhelm everybody with how different it is.

Finally, we think there will be marketwide adjustments in response to TDV. We think the designers and the building community will learn from TDV how to make more -- or less peak demanding buildings out of this process, and the equipment that helps us to do that will improve its position in the market.

And finally, if we don't do this now, when and ever are we going to do this. As Bill explained in his introductory remarks, the idea has been around for 15 years. This is the only time when we've come this close to adopting a Time

Dependent Valuation strategy, so we think it's now or never.

So, with that, I will cede the podium to the next speaker, and I apologize for talking too long.

MR. ALCORN: Okay. Looks like we have a question or two.

MR. SCHWARTZ: Yeah. Actually -- this is Peter Schwartz. I have three questions. Some of this is a little bit of carryover from this morning. But does -- do the system peaks mapping the utilities onto the climate zones account for the distribution in areas within the utilities, with their own peaking characteristics?

For instance, PG&E has different distribution areas, and they don't share the same system peak. Some of their areas are winter peaking, some are summer peaking, some are, you know, have various peaking. So I wanted to find out whether or not that was accounted for.

MR. FERNSTROM: Gary Fernstrom, PG&E. So the answer to that is yes, we initially looked at this from the standpoint of distribution planning areas, but PG&E was the only utility in the state that utilized them. Edison and San

Diego Gas and Electric tend to do planning on a systemwide basis, and PG&E is in the process of phasing out their DPA approach. So we correlated the distribution planning areas with the climate zones, and used climate zones as a proxy.

MR. SCHWARTZ: Okay. Second question. How does TDV deal with a site that is essentially off the grid; in other words, self generating, with its own peaking characteristics and certainly different economics?

MR. FERNSTROM: I --

MR. SCHWARTZ: It may well be something, you know --

MR. PENNINGTON: It doesn't.

MR. SCHWARTZ: -- poor design.

MR. PENNINGTON: It doesn't do that. So there's no --

MR. SCHWARTZ: So if I'm a high tech firm that's putting in my own cogen, and I want to get code compliance and yet I have different characteristics and needs than a building on the grid, I may well be penalized, under this current methodology. This is your pathological case, potentially.

MR. RAYMER: But you get penalized under

the old way, too.

MR. PENNINGTON: I think you're going to want to get your loads down in that building as well as you can, in order for that energy source to be, you know, cost reasonable. And so you're probably going to be --

MR. SCHWARTZ: Right. Right, but the point --

MR. PENNINGTON: -- you're probably going to be way past compliance with the building standards at that point.

MR. SCHWARTZ: It depends. It really depends, because what you typically have are a mixture of comfort conditioning and process loads, and the systems that you choose to put in your building may run counter to what gets valued under the TDV methodology. You know, that your mix of chillers, you know, the whole sort of complement of equipment may well be -- have a different driver than what TDV provides.

MR. FERNSTROM: Well, let me respond to that. First of all, under the notion of off grid, you can either be utilizing renewables, solar, wind, something like that, or cogen, which in fact uses fossil fuel, most likely natural gas. If you're off grid and using renewables, because of the high cost of those systems you would tend to want to minimize your peak demand in order to reduce the cost of your investment in your renewable generation systems. So this time dependency becomes relatively more valuable, and it would seem to me that since energy efficiency is a lot cheaper than generation of any kind, you'd want to invest more heavily in efficiency, particularly in those measures that affect on peak use.

MR. SCHWARTZ: Yeah. I'm not disagreeing with what you're saying. What I'm trying to get across is I may have a campus of buildings, or large buildings with significant loads that may have different peaking characteristics than the system peaks, under the TDV methodology. And so you have a mis-match of system peaks, you know, because I'm experiencing my own local system peak, and your complement of equipment serving your loads may be penalized, under the TDV methodology. That's all I'm trying to get across here.

I'm not disagreeing with you, Gary, because the, obviously, the whole point is trying to reduce your loads and get them matched so you get a nice flat load. What I'm saying is there may be some penalty for doing that.

MR. WILCOX: Well, I would say that if you have to comply with the standards with this set of buildings, which if you were doing renewables and stuff you -- there's a lot of exemptions for that stuff. But if you were having to comply under the current system, you're not going to have an optimum situation for your cogen system either. It's not clear that --

MR. SCHWARTZ: Right, but we're supposedly moving forward, aren't we.

MR. WILCOX: Yeah. Well, it's not clear that what you propose is a better move forward than what's being proposed here, I would say, for the --

MR. SCHWARTZ: Yeah. I just, because I know the CEC and others are promoting distributed generation, and I hate to see a methodology that somehow penalizes moves forward.

MR. WILCOX: You can always use the prescriptive standard to comply. And then, no problem.

MR. SCHWARTZ: Okay. And, last

question. Did you do an assessment of the overall energy and environmental savings based on the total hours of operation versus peak waiting? So, in other words, did you look at total savings versus, you know, what -- the TDV methodology, in cents?

MR. FERNSTROM: I'm not sure I understand the question, Peter.

COMMISSIONER ROSENFELD: I don't understand the question, either.

MR. MATTINSON: Total the current method?

MR. SCHWARTZ: Well, in that sense, to some degree. But what I'm looking at is kind of the shoulder, seasons where if you -- if you're incenting reduction in peak, the actual hours where peak occurs is usually quite low. And so your equipment is operating at part load more than it's operating at full load. And so I'm just simply asking if you look at the total consumption --

MR. FERNSTROM: I'd have to check with E3 to be sure, but it's my understanding that the externality evaluation was across the board. It looked at on peak, shoulder peak, and off peak time periods.

MR. SCHWARTZ: Okay. Yeah, I just wanted -- thank you.

MR. GATES: Steve Gates, with Hirsch and Associates. I've been trying to think of how one might gain this, and I really haven't been able to think of very much. But there is one scenario I'd throw out, just for consideration.

Let's say you have a facility that because of other considerations has emergency generators onsite. And so as part of this, you say okay, we're going to run these generators on peak. And because of that, you can now get by with a lot more glass, or, you know, other credits, you know, because of this on peak generation.

Now, if there's a significant enough difference between what it actually costs to run those generators on peak versus what they would just actually be able to buy power for, you know, could there be a scenario where this is presented as, you know, we're going to run these on peak, but in reality there's no intention of ever running them on peak? You know, it's -- is that a possible scenario?

MR. FERNSTROM: Well, I don't think in the building standards you can trade off generation for building measures. I think where you might see emergency generation run is in the case of some dispatchable load management program that the state may offer, where customers are rewarded on a dynamic or real time basis, depending upon the electric load, to reduce their own building load.

But I don't think we're going to see an interaction between a generation source and building measures in the building code.

MR. GATES: So actually, if I'm hearing right, you know, trade-offs such as running, you know, having generators onsite, that type of thing, are not valid alternatives in the ACM.

MR. FERNSTROM: I don't believe that's part of the ACM, and you can't do trade-offs of that nature now.

MR. ALCORN: John.

MR. AHMED: I have a question for Doug.

MR. ALCORN: John Hogan, actually.

MR. AHMED: Okay.

MR. HOGAN: John Hogan, City of Seattle. I wanted to ask about any potential unintended consequences here, of how this might affect demand crises. So it seems like the whole focus of this, I want to talk specifically about the mechanical refrigeration versus an economizer. It seems that the whole notion here is you're trying to find out what the best thing is at peak demand, and presuming that you'll always serve that peak demand, as opposed to maybe also thinking about can peak demand be reduced five or ten percent during actual operation to deal with a crisis, such as was done in the past year here.

If people install mechanical refrigeration, it seems it's sort of on or off, you don't have a way of reducing that peak demand if there were some time when you wanted to reduce it.

MR. FERNSTROM: Oh, I think --

MR. HOGAN: If you had an economizer, you could probably use that until, what, 10:00 a.m. or sometime in the morning, and get some benefits, have a space be more habitable and usable. And so as you move forward with this, think about that aspect, also, I guess as a comment.

MR. FERNSTROM: Well, I think there is a

way to reduce peak demand dynamically, and that would be through a smart thermostat or some other control mechanism that would effectively raise the temperature in the building, and reduce the air conditioning load on a dynamic basis.

I'm not sure if that answers your question.

MR. HOGAN: Well, it seems economizers can have some benefit, too, and that maybe they're being sort of ruled out more than they should be, just by simply looking at it this way. Or maybe there are other parts of consideration of them, too.

MR. FERNSTROM: No, they're not being ruled out. They'd have relatively less credit because their benefit isn't on peak. And this whole system gives relatively more credit for on peak measures. I don't think we'll see economizers disappear.

MR. ALCORN: Ahmed.

MR. AHMED: Looking at the graph that Doug had for Climate Zone 14, for the offices and the retail. I was under the impression that under TDV, higher efficiency, higher EER air conditioners should get significantly higher credits, but this graphs shows a comparison between the TDV values and the source values. How -- there's very little difference.

MR. PENNINGTON: What climate zone are you talking about? What charts are you --

MR. AHMED: Well, Climate Zone 14, and I don't know if it is -- it has to do with the climate zone, or --

MR. McHUGH: Climate Zone 14 retail?

MR. AHMED: Yeah, retail and office, both.

MR. McHUGH: This is slide --

MR. AHMED: Page 12 of the presentation, slide number I don't know what, 71.

MR. McHUGH: -- 72.

MR. AHMED: Seventy-one and 70, 72, I mean. Yeah.

MR. McHUGH: This is John McHugh, with HMG. What you're seeing here is that there's two issues. One issue was the residential model that looked at evaluating the EER separately from the SEER. And when you start looking at the EER, that's looking at its on peak performance, or high temperature performance, versus the -- an SEER that assumes seasonal performance.

What you're looking at here with the office is that the measure that we looked at was increasing the EER of the equipment, and did not make any assumption about that the high temperature performance changed dramatically between the two. So it's, basically it's changing the air conditioning efficiency equivalently across all temperatures.

So we didn't -- so this measure is not saying that we have an air conditioner that performs poorly at high temperatures versus one that performs substantially better over high temperatures. It's just comparing one efficiency level to another efficiency level, and it's just bumping it up by a couple percent.

Is that answering what the question is? I mean, it's --

MR. AHMED: To -- I understand. But I thought that at higher temperatures the curves go down anyway. So if you are using a higher EER equipment now, and the conclusion is that difference between a flat and TDV indicated demand type of measure, so in this case, with higher EER you should see a significantly higher margin, under TDV.

MR. McHUGH: Well, yeah. What's happening is that you're getting -- that the number of hours that the air conditioner is operating is over a large number of hours over the course of the year. So it's affecting peak, but it's also affecting a lot of off peak hours, as well. And so even though air conditioning is given more benefit under TDV, it's not this dramatic change that's only occurring under high temperature hours.

MR. AHMED: It's almost insignificant. Therefore, I was wondering what if --

MR. McHUGH: Well, hold on a second. When you say it's almost insignificant, we're looking at a --

MR. AHMED: I can't read it.

(Laughter.)

MR. McHUGH: You're looking at like a ten percent change.

MR. AHMED: Is it, really?

MR. McHUGH: Yeah. I mean, you look at this one -- it's hard to say, because we're not -- we're rounding. But I think that's -- you're looking at something that's around 5.8. I'm looking at the office one, and it's increasing to about, you know, 6.2 or something like that. It's about ten percent. So, yeah, it's not -- it's not something that's revolutionary. It's an evolutionary kind of thing. We're pushing things in the right direction. We're not completely overturning, you know, the basis of the standards.

MR. AHMED: Right. But my concern was that, I mean, going to TDV we are supposed to get very good credits, high credits to measure that offset peak. And this is a measure that's supposed to offset peak with high EER. And yet it's getting only a ten percent credit. That's what I was wondering.

MR. McHUGH: Yeah.

MR. ALCORN: Okay.

MR. FERNSTROM: Well, Ahmed, to the issue of getting a great deal of credit for on peak measures, in order to have this proposal be acceptable to all the key stakeholders, there has to be moderation. If enormous credit were given to on peak measures, then we'd see things like economizers, and insulation perhaps, for that matter, become relatively less valuable, and that's not an intended consequence either.

MR. ALCORN: Okay. Lance. We have

about another one or two minutes.

MR. DeLAURA: This will be quick.

MR. ALCORN: Okay.

MR. DeLAURA: Back to the question of heat pumps and furnaces. In the wintertime, when electricity is valued lower than it is in the summer, how would you evaluate an electric heat pump against a gas furnace? And I heard the answer earlier that, you know, gas for gas was going to stay about the same.

If we're looking at a methodology that's valuing peaks and non-peak, how would you treat the heat pump in that instance? Does my question make sense?

MR. NITTLER: Yeah. Since you're not comparing between fuel types there, you'd be comparing -- at least in the current ACM, the heat pump gets compared to a heat pump. So on both sides that the standard had proposed you'd have about the same valuation.

So my guess at this juncture is that it wouldn't change a whole heck of a lot.

MR. ELEY: The answer would be different if it's non-residential, though, because then you're comparing against a chilling mechanism.

MR. DeLAURA: Can you carry that out, so how would that play out?

MR. ELEY: Well, I don't know, did you look at that --

MR. McHUGH: Not for non-residential.

MR. ELEY: I don't know that we know the answer to that, Lance. But for non-residential buildings, base case it's always an electric chiller.

MR. DeLAURA: So there actually could be an instance where it would be favored over the gas.

MR. ELEY: I think it -- my hunch is it would be pretty favorable to the gas chillers, based on the stuff that we saw in here. But based on those earlier graphs, it --

MR. McHUGH: You're saying a gas --

MR. MAHONE: He was asking about a heat pumps versus a furnace.

MR. ELEY: Oh.

MR. DeLAURA: Yeah, in the heating mode.

MR. ELEY: But then it drifted into a gas air conditioning unit. Oh, never mind.

(Laughter.)

MR. McHUGH: We had looked at earlier

comparisons of gas furnaces to heat pumps, and what we found in general is that the heat pump consumes more TDV energy, so if there actually wasn't that rule in the ACM, that gas furnaces would be advantaged. But that's not how the current rules are set up.

MR. MAHONE: Let me just put -- this is more of an announcement than a question. The last slide in our handout lists the project Web site, and you can get a copy of this whole TDV code change proposal, the spreadsheets, you can get a copy of the methodology for applying TDV, hourly factors to simulation output results, that stuff is all available on the project Web site.

And I will also put this slide presentation on the project Web site, after today.

MR. ALCORN: Great. Thank you very much, Doug.

The next topic is the Life Cycle Cost Methodology, and Charles Eley will be presenting that topic.

MR. WILCOX: Charles, I was going to ask you if you had any opinion about gas chillers.

(Laughter.)

MR. ELEY: I told Bill that was a great

answer, if someone would just ask the question.

Okay. The -- what we're going to talk about now is the Life Cycle Cost Methodology that's going to be used for the standards update, the 2005 standards update.

There's two documents you may want to refer to. One of them is a paper outside that's just titled Life Cycle Cost Methodology. Looks like this. And the other document is just a copy of the slides that you're going to be seeing.

MR. ALCORN: Is that outside, too?

MR. ELEY: Yeah, they're both outside.

Can you go back one?

The -- where we're starting from is the Warren-Alquist Act, which requires that the Commission demonstrate that standards are life cycle cost effective, when taken in their entirety and when amortized over the economic life of the structure. The "in their entirety" means that you could actually have a package of measures and one thing might not be cost effective, it might be carried by something else that is cost effective.

The truth of the matter is we've never really done that. We've always shown that every measure individually is cost effective, and that's the approach we're planning to take now.

Next slide, please. With TDV, there are really two methods for calculating life cycle cost and cost effectiveness. The first method is the annual method, and the second method is the hourly method.

All of the standards worked in the past has used the annual method. With this method, the net present value of energy savings is calculated by simply multiplying the annual savings by a present value, which is assigned to either electricity or gas.

With the hourly method, the present value of the savings will vary with each hour. So it's essentially the same method, except that the value, the present value that's assigned to savings will be greater for some hours and lower for others.

Next slide, please. We can skip this one. Doug's covered that.

Getting on to the annual method. The key points of this method are as follows. If a measure reduces the overall life cycle cost, compared to the base case or the previous measure, then it's considered to be cost effective. We talk about life cycle cost, but we really don't care what the absolute life cycle costs are. The only thing we care about is whether life cycle cost is reduced as a result of a measure.

So the equation, or the formula that's used is that the change in life cycle cost is equal to the change in initial cost, which will tend to be a positive number, minus the present value of electricity savings, minus the present value of gas savings. So if the present value of your electricity and/or gas savings are greater than the initial cost, then the measure is cost effective. And that's the fundamental basis that's used.

The present value of cost savings is also calculated fairly straightforwardly. It's simply equal to the energy saved per year, and for electricity the units are kilowatt hours per year, for gas the units are therms per year. And these savings are then multiplied times the present value per unit of energy saved over the life of the measure, or the life of the building. And those units are dollars per kilowatt hours per year or dollars per therms per year.

Next slide, please. There are a number

of economic assumptions that are built in to this, and these really have not changed in ten years or so. I mean, we've -- and we don't propose to change them now, either. The first one is the discount rate of three percent. This is a real number, it does not account for inflation. It's a real discount rate of three percent. So energy savings that happen next year are discounted at the rate of three percent to bring them back to present value. And two years away it's three percent times three percent, brought back to present value. That's the discount rate.

MR. ALCORN: Charles, I have just a tiny remark. When you, like after the -- you know, why don't say on the transparency it's three percent -- it just says three percent, and how am I to tell.

MR. ELEY: Oh, okay. The real point, yeah. Okay.

Now, for non-residential lighting and non-residential HVAC measures, the energy savings are considered over a time horizon of 15 years. And this is a precedent that's also been in existence forever, at least since '92 standards.

For low-rise residential buildings,

however, a 30 year time horizon is used, and for non-residential envelope measures a 30 year time horizon is used. This precedent was set with the AB 970 changes when we went to a 30 year time horizon for non-res envelope measures.

The shorter time horizon for HVAC and lighting measures in non-residential buildings is due to the term rate, and in office buildings and retail stores it's due to the fact that a lot of the packaged equipment that's used isn't going to last longer than that. So, but on the other hand, insulation that's installed, windows that are installed in non-residential buildings would have a 30 year time horizon, so that's used.

The price projections for electricity and natural gas are again taken from the CEC forecasting group.

Next slide, please. So these are the present value numbers that are used in the analysis. So, for instance, the value for a kilowatt hour of energy saved by an HVAC system would be worth $1.37. So if you had a measure that saved a thousand kilowatt hours, that would be $1370 of present value saved. So it's real simple, easy to use.

You can see that for the 30 year time horizon, that would go up to $2.10, and there's not a great deal of difference between residential and non-residential for the 30 year time horizon, $2.06 for res, and $2.10 for non-res.

For natural gas, the values are $14.21 for a therm of gas saved each year for the life of the building. And for non-res, $12.64 for a therm of gas saved each year for the life of the building. And for the 15 year time horizon, it's $7.30.

Next slide, please. Now, you may -- you probably want to look at the slide. I don't know that you'll be able to read this one up there on the screen. I can't even read it here, except I know what the numbers say.

In the top portion up here are the values that we're proposing to use for this round of standards update. Those are the identical numbers that were on the previous slide. Okay. Now, for historic reference, we've shown the values that were used for the AB 970 updates, and they're a little bit lower than -- not very much, but just a little bit lower than -- well, hang on.

The first group is the '92 standards,

which are definitely lower. And then after that is the AB 970 standards, which are similar to the -- to what we're proposing to use now. The AB 970 standards, we actually had price projections for two sizes of commercial buildings, small and medium. And these went back to the -- these were from the forecasting group. We did not use any of the small numbers, so you can basically ignore that column for small, and just base your comparison on the medium case.

So under AB 970 we were valuing a kilowatt hour of savings over a 30 year period at $1.68; now it's $2.10. So it'll be a little bit easier to justify building envelope measures under this procedure.

Also, just for historic reference, let me point you down to the bottom here where it says ASHRAE Standard 90.1-1999. When these standards were justified, the value they assigned to a kilowatt hour of savings was only 64 cents, which is about one-third of what we're now using for our savings. The reason this is relevant is because some of the measures that we're considering are coming from ASHRAE Standard 90.1. So therefore, if they were shown to be cost effective under the

90.1 economic assumptions, they should be -- and assuming the initial cost is similar in California, those measures should be more than cost effective in the California economic environment. Likewise, for gas, the ASHRAE number was $4.48, and we're looking at $7.30, or so.

Okay. So that's the life cycle cost, that's the annual life cycle cost method. The next slide, please.

With the hourly life cycle cost method, we basically repeat the same process, but we do it for each hour of the year, and you add up the numbers for each hour. And the -- what changes is that the savings would be difference for each. Some measures happen during times when the TDV present value is high, and some when the TDV present value is low.

PG&E has developed values for both residential and non-residential buildings, and for 16 different climate zones. And there's also values for electricity, natural gas and propane. So if you multiply all this out, you have I believe 96 different time series of data, and each time series of data has 8,760 records in it. So there's about something on the order of 80,000 datapoints of information that's contained in the TDV proposal.

Hang on just a second here. Next slide. Yeah, let's go on.

Now, again, you'll probably need to look at your slides for this one, because it's very difficult to understand it here, or to see it up on the screen. This slide is sort of a statistical summary of the TDV present values. And that's also contained in the methodology paper that's here.

And let me just take -- let me just walk you through the format of this, and after that I think you can sort of scan it. Let's say we're in Climate Zone 3, which is here. And Climate Zone 3 is the San Francisco Bay Area down to about Monterey. So the average present value of electricity is $1.26. Remember, under the annual method it was $1.37 for a 15 year time horizon. And the maximum value is $5.74, but that probably doesn't happen for more than just a couple of hours during the year. The minimum value is 66 cents, and the standard deviation is 45 cents.

So that means that for about two-thirds of the time the present value will be $1.26 plus or minus 45 percent. And for roughly one-sixth of the time it'll be greater than that, and for about one-sixth of the time it will be lower than that.

Next slide. This one just shows the next four climate zones, 5, 6, 7 and 8. Next slide, same thing. I can just leave one slide up there, because you really can't read them, but hopefully on your handout you'll be able to.

So I guess the closing point that I want to make about this is that we're not recommending in the methodology paper that everybody use Time Dependent Valuation to show cost effectiveness of measures. It's acceptable, it's acceptable to use the annual method, and if a researcher shows that a measure is cost effective using the annual method, that's enough.

Now, there are some measures that would benefit from a TDV analysis, like cool roofs, the ones in Doug's winners column, probably. And the researcher may, at their option, choose the TDV or the hourly method for those measures. But they don't have to. If you can show that the measure is cost effective using the annual method, then that's enough.

With that, I'll close, and answer any

questions, Bryan.

MR. ALCORN: Okay. Thank you. Yes, Commissioner.

COMMISSIONER ROSENFELD: Charles, I have a simple question. Just trying to look back. You said that these ASHRAE numbers are much less than the California numbers.

MR. ELEY: Yes.

COMMISSIONER ROSENFELD: Is that because electricity was -- there could be two reasons. Electricity was cheaper, or was it because they -- I seem to remember they used a seven percent, you know, discount rate.

MR. ELEY: Well, what ASHRAE did, first of all, they used the average nationwide electricity price of eight cents a kilowatt hour, and 56 cents a therm. But then on top of that, they used, ASHRAE used something called a scaler ratio, which embeds discount rate, the life of the measure, maintenance cost, all of these things, and they came up with a scaler ratio of eight.

So you take the eight cents a kilowatt hour, you multiply it times eight, and the eight you can think of as a series present worth factor, in engineering economics terms, or a simple payback, I guess, if you wanted to think about it that way. And that's -- that was the basis of ASHRAE's method. So that the 64 cents, it's eight times eight cents a kilowatt hour. And the gas number is eight times 56 cents a therm, I believe it was.

So the equivalent scaler for our economic assumptions is more like 19 for California, if we were to translate it into scaler terms.

COMMISSIONER ROSENFELD: Thank you.

MR. ALCORN: Are there any other questions? Ahmed.

MR. AHMED: Just a comment on the discount, or on the present worth value -- the present worth factors used for AB 970 and then 1992, and now this number for -- the numbers now presented for TDV for 2005. Just a question to Bill regarding the discount rate and these present worth numbers. How often will they really change? If there is another rulemaking, say, two years from now, will they be revised, or there's going to be some sort of a set calendar?

MR. PENNINGTON: Well, the standards are, you know, unless the legislature directs us to do otherwise, are generally updated on a three-year cycle. And whenever we do cost effectiveness analysis in a standards proceeding, we usually take a fresh look at what the forecast values would be.

For example, in 1995, we didn't propose to do anything except make the standards easier to understand. And so in that round we didn't change, we didn't look at any forecast values.

MR. AHMED: One other question. Charles, in your -- the change in life cycle cost calculation, basically you are comparing the measure against its current practice? In other words, would you say if you were to compare R-30 over R-19, you'd take the cost of R-19 and the cost of R-30, the difference would be the incremental cost, and then the savings? Is that how it is to be done?

MR. ELEY: Well, sort of. Actually, that's -- that question raises another issue. For something like insulation that's sort of on a continuum, you know --

MR. AHMED: Right.

MR. ELEY: -- you can go from R-7 to 11 to 13 to 19 to 22 to -- what you do is as you apply this analysis, your base is what was previously shown to be cost effective.

MR. AHMED: Okay.

MR. ELEY: As opposed to -- or at least that's the approach we're taking here. Now, in terms of the statute, I think we can go back, though, to whatever the previous standard was and just show that it was cost effective relative to that.

MR. AHMED: Right, the AB 970 package.

MR. ELEY: Yeah. But, for instance, when we did the -- we applied this same method to the fenestration requirements for non-res buildings, and each measure is shown to be cost effective relative to the last measure that was cost effective. So that way, you reach the minimum point of the life cycle cost curve, rather than starting to climb that life cycle cost curve back up the other side.

MR. AHMED: Second part of the question was how will you take into consideration interplay of measures, when you'll have to set standards for different measures and they could be interacting, and on a total basis they could be less cost effective than if they were individually, because of the combination of -- or the reduction of savings.

MR. ELEY: Well, my experience is they're more cost effective when you consider the interplay and the interactive effects. But to answer your question directly, we tried to analyze each measure by itself, on a continuum, and to find the cost effective level of performance for that one measure.

What this -- the implication of this is that we probably do not achieve the economic optimum for the building as a whole by applying this measure.

MR. AHMED: Individually.

MR. ELEY: I mean, an example is, for instance, when this method was applied to non-residential fenestration, one of the things we chose to not consider was the impact of downsizing HVAC equipment because of the better windows. Had we included that impact, it would've in effect reduced the cost of the windows and made it even more cost effective, and it would've enabled us to go maybe even further than we did with the --

COMMISSIONER ROSENFELD: So why on earth didn't you?

MR. ELEY: Well, we got -- the short answer to that is we got pretty darn far without having to consider it, and we didn't feel that practically we ought to go much further, just because the -- of the nature of the windows market for non-residential buildings. We felt we were kind of pushing it as it was. Because for one thing, we went from a 15 year time horizon to a 30 year time horizon, and that one change enabled us to really require basically low E double glass throughout all of California, and that's now the base standard.

MR. AHMED: So then, Charles, how are we going to come out with a buildable package, then, in the standards?

MR. ELEY: How are we going to come up with a buildable package in the standards.

MR. AHMED: Right now we have the packages A, B and D.

MR. ELEY: Yeah. That's a good question.

MR. WILCOX: Are you talking residential?

MR. ELEY: Residential.

MR. AHMED: Yeah, residential.

MR. PENNINGTON: We're going to be exploring that, not at today's meeting, but, you know, as we get into -- we've got a report related to glazing area, we've got, you know, a number of reports that are going to be looking at improvements to the standards, and sort of coming up with the buildable packages needs to be based on all of that work.

MR. AHMED: Right.

MR. PENNINGTON: You know, it all needs to play together. So I think we're not --

MR. AHMED: Yeah. I'm looking at a --

MR. PENNINGTON: -- ready to talk about this in much detail.

MR. AHMED: Okay. I'm looking at the combination of runs, for example, if you have high efficiency air conditioner and increased insulation, a combined effect may not be as high as, say, air conditioner only, and the increased insulation only.

MR. WILCOX: Well, in all the analysis we did for AB 970, we did subtractive analysis, so we analyzed the combination of all the proposed measures and then removed one to look at its cost effectiveness. So we were actually taking the most conservative view of that, because we -- the way we did it, you got all the --

COMMISSIONER ROSENFELD: It's not the most conservative, it's the right one.

MR. WILCOX: Thank you, Art.

(Laughter.)

MR. PENNINGTON: Good job, I think he's going to say.

MR. WILCOX: But anyway, that way you get the interaction at the end point.

COMMISSIONER ROSENFELD: Charles, usually I'm egging on for efficiency, but I can't resist saying that the only part of your 30 year hypothesis that, in my humble opinion, doesn't work at all, is we have double glazed windows at our house, and they're not lasting anywhere near 30 years.

MR. ELEY: I know. I've got some seals in my house that are starting to fail, too.

MR. ALCORN: All right.

MR. FERNSTROM: Well, many of those products come with a ten year warranty, and that's about how long some of them last.

MR. RAYMER: Yeah, they all do.

MR. ALCORN: We have one more question

from Rob Hammon.

MR. HAMMON: I'm just curious. Charles, you've gone over the method. I'm just -- now, the next step in life cycle analysis is what? Do you have a list of features that you're going to -- what's the next step?

MR. ELEY: Well, we have -- yeah, there's a whole host of measures that are all being analyzed. And what I presented is the procedure that's being used by each of these researchers. So you'll hear the details of how this method is applied, not at this workshop, but at the one in April 23rd.

MR. HAMMON: Is there a list of features that are being analyzed?

MR. ELEY: Yeah, basically it's the list that was brought up at the November 15th and 16th workshops, and then the Commission sent out a --

MR. HAMMON: Is that like 24 or --

MR. ELEY: Yeah.

MR. ALCORN: There's a notice of maximum scope that's on the Web --

MR. ELEY: Yeah, those are the ones that are on the table, Rob. There's a few others, by the way, that are being done outside of our research team by PG&E and various others.

MR. ALCORN: Those are covered in the same notice.

Are there anymore questions or comments on this last topic?

All right. In that case we'll move on to the next topic of Residential Computer Modeling Changes.

MR. WILCOX: That was the last topic. This is the last one.

MR. ALCORN: Yes. The next topic.

MR. WILCOX: Okay. We're going to talk about residential computer modeling changes, and it's kind of a changes squared situation because there were a couple of things that have been changed in the -- since we printed the handout. So I'll point those out as we go along.

So what we're talking about here are changes in the rules for how the ACMs calculate energy for the proposed house and the reference house. And mostly they're pretty arcane things that are pretty -- that are I think in all cases invisible to the ACM user, but they do have an impact on the way the calculations come out.

We've made some revisions for a couple

of reasons. One is because there are a number of issues that have been around for, in some cases, several years, where people have commented that what we were doing didn't make sense or wasn't the best calculation, or whatever. And for reasons of not wanting to disrupt the process and make changes in the standards in the middle of a process, the changes weren't made in the AB 970 or the 1998 standards. And those, several of those have been sort of accumulating over the years.

We also made some changes that were aimed at making the TDV analysis work better and be more representative of reality, and so forth. So you can look at these as a package of proposals that are all kind of meant to work together to represent residential computer building calculations.

So I'm going to talk about changes to slab edge modeling, natural ventilation, thermostat settings, glazing obstruction factor, and then, you know, envelope leakage is added since the thing got printed. It was left off due to an error. We've been recently working on this stuff and some of it, some things have changed since the last -- we wrote that little paper.

So if we go to the next slide -- we're already there. Sorry, don't change. Slab edge. In the current calculation method, the one that's in place in the 2001 standards, slab edges are treated in this kind of very simplistic and oversimplified way, as if they were an exterior wall that was exposed to outdoor air, and without any mass or any lag involved; that they simply had a conduction to outdoor air temperature.

This has been the case for a long time. It's very simplistic. You take the F-2 factor for the wall, for the slab edge, and then you just say okay, that's just the conduction from an indoor temperature to outdoor temperature. And it's been known for quite some time that this was not a very good model, and we've made some moves to change it as long ago as the '98 standards, and never managed to actually make it all work.

What -- this model systematically overstates the hourly heating and cooling loads. In the summertime, because when it's 105 outside you're actually gaining heat through -- the model says you're gaining heat through the slab edge at a pretty high rate. And when it's, you know, 30 outside, you're losing heat at a very high rate.

And the best technical models actually would say that you never get anything like that big heat flows out of a slab edge, because the slabs connected to the ground, and it never really sees those big temperature extremes.

So, and this is particularly important for TDV, because we're now talking about hourly modeling and dealing with the hourly loads in a way that makes -- is more important, and so forth. The effects are -- may be important.

So the proposal here is to change the slab edge to being a surface that's connected to ground temperature rather than outdoor air temperature, and we looked around and found an available model for a ground temperature that seems to be a reasonable approach. It's one that the -- you use a monthly temperature, which is lagged a month and a half or so from the outdoor monthly temperature, and the extremes are reduced from -- the annual cycle is reduced from what the outdoor temperature is. This, it turns out, is produced by the DOE 2 weather packer as one of its outputs, and it's used in a lot the DOE 2 calculations. And so we've done some work, and the current proposal is that we use that temperature as the connection to the slab edge.

Now, for almost every case of concern, at least in production housing, this is kind of a non-issue because the -- most production housing does not have slab edge insulation. It's the same for almost all the climate zones, it's the same case for the reference house as it is for the proposed house, and so it's an apples to apples comparison which wasn't going to change both of them. And it's invisible to the compliance user and so forth.

There is a -- there's some chance that we might, after we did this analysis and made this proposal, we got a comment from some of the people at LBL that they thought there might be a better model that's related and similar, but a little more complicated. And I'm not sure that it's going to be very different. We're looking at that to see whether it really makes a difference or not.

So that's the slab edge proposal.

Natural ventilation --

MR. GATES: Bruce, can I ask you a question on that first?

MR. WILCOX: Certainly.

MR. GATES: One of the thoughts that's occurred to me with the slab edge models, and particularly with residential, is -- well, actually, residential and commercial, you know, the -- as you stated the DOE 2 assumes, you know, this ground temperature that's time lagged by a month or two, and one of the things that's quite relevant, though, is what's actually on the ground around the building. And in the case of residential buildings, in particular, most of the ground around the building itself is irrigated. And I've actually wondered whether using the average wet bulb temperature lag might be more relevant than actually using the average dry bulb temperature.

So I don't know if any of these models look into that at all, but it's -- it just seems to make sense, you know.

MR. WILCOX: Yeah, I understand. I know that the more complicated LBL model, one of the inputs to the analysis they used to develop it was the conductivity of the ground, and they were arguing that the conductivity, fairly high conductivity was good because of the fact that it's irrigated around houses.

I think it's very complicated, because I think it also tends to get very dry underneath the slab, so, yeah, I don't know. It's -- I've never seen anybody using a wet bulb model.

MR. GATES: Yeah. I just haven't -- I don't know that I've seen a good model yet that really addresses all of these different issues. But in terms of a simple one, I wonder if -- I suspect the wet bulb might actually be a better indicator.

MR. WILCOX: Well, we can -- we've received another comment.

MR. AHMED: Bruce, another question.

MR. WILCOX: Yeah.

MR. AHMED: How much energy is really lost from a slab edge?

MR. WILCOX: According to the models it's pretty big. It's a substantial -- particularly in heating, it's a substantial part of the heating load. Do it's definitely, you know, since if -- if slab edge insulation was a big item here, then it would be really important. But since it isn't, then it's more or less of a context situation to kind of give you the overall energy balance of the house. But it's on the order of 20 or 25 percent of the heating load, setting a house on an uninsulated slab. It's a big deal.

MR. AHMED: Why aren't houses on insulated --

(Laughter.)

MR. ALCORN: Come on, Bob.

MR. RAYMER: Okay. We've got -- okay. Bugs.

MR. ALCORN: Termites.

MR. RAYMER: And mold. Short story.

MR. WILCOX: Okay.

MR. RAYMER: Oh, and cost.

MR. WILCOX: Natural ventilation. The current residential ACMs assume that kind of an optimum window ventilation scheme is in place 24 hours a day, seven days a week. And if you -- the model assumes that if you could open your windows and ventilate with outdoor air it would avoid the need for air conditioning if you're going to do that, and manage it. And they're, you know, including changing the settings of your windows hourly all night long, and things like that. There's been some comments over the years that this is a somewhat optimistic view of family behavior.

It also has the side problem that it's so optimally efficient, and it uses no energy at all to have the household that's jumping up every hour and opening and closing windows is very efficient from the point of view of standards, that any mechanical ventilation system that you would propose to use has no possibility of being cost effective or even being usable in a compliance context.

So for those two reasons, the proposal here is to make a change to reduce the amount of ventilation. We thought the ventilation at night was the part that was the most outrageous, so the proposed change here is to turn the ventilation off from 11:00 p.m. to 6:00 a.m. and just assume that windows are closed from 11:00 p.m. to 6:00 a.m.

Again, this is the same thing, it's buried in the rules. It's not an input. There's no -- nothing that the user has to do, and it's the same on both sides of the proposed versus reference house.

Daryl.

MR. HOSLER: Daryl Hosler, Southern

California Gas Company.

Bruce, obviously this would give some help to mechanical ventilation, but I know in southern California it's not unusual to leave your windows open. So what was the basis for closing them from 11:00 to 6:00 a.m.?

MR. WILCOX: I don't think there's any perfect answer to an average behavior situation. I think that really depends on the climate zone. It depends on the people, it depends on whether you're in an urban situation where you're worried about security or not, and so forth. I think what we decided is it was plausible to assume that a lot of people are in a situation where they wouldn't want to leave windows open at night because of security reasons. Bill, for example.

So it seemed like it was a reasonable thing to do, and it seemed to be, you know --

MR. HOSLER: Yeah, I think that's something that needs a little more -- I don't disagree that opening and closing it every hour is the right answer, but going just as far to the opposite side with no basis doesn't seem to be the right answer, either. If you're going to make a change, there ought to be a little more rationale for it, I would think, because in lots of parts of the country people do leave their windows open. And it just doesn't seem to, you know, be intuitive that that's a right way to answer that.

MR. WILCOX: Well, this is -- you could regard this as kind of a compromise. What we've had up to now has been hopelessly optimistic. We assumed that everybody in every house always did the --

COMMISSIONER ROSENFELD: No, but you're getting to -- it's clear that people don't get up at 3:00 in the morning and change the window. But I'm a little bit -- I may not be representative, but I don't think on any summer night I've ever in my whole life slept with the windows closed. And I don't think it's fair for you just to say well, that's suboptimal, or optimal, or something.

MR. PENNINGTON: I think the issue is that the behavior is all over the map.

COMMISSIONER ROSENFELD: Yeah.

MR. PENNINGTON: And some people's experience is that they always close the windows. And, you know, there's ordinances in southern California that, you know, expect that the windows are going to be closed, and require mechanical ventilation because of that.

You know, I think if we went around the room everyone would have a different experience, you know, what they do.

MR. HOSLER: There's ordinances in southern California that expect the windows are going to be open and limit the noise that your air conditioner can make, too. So I'm not sure what the other ordinance is, but I am aware of that one.

MR. WILCOX: So I guess the choice here is to try -- if we try and come up with -- what we were shooting for is something that gave a less optimistic view of ventilation, that was in some ways rational, and arguably could be plausible. And, but we don't have -- we know that people in Fresno are going to operate their houses differently than people in, you know, Los Angeles. I mean, that's clear. This has a different impact. We've looked at the impact of this and it doesn't appear to, you know, throw any sort of wild curves into the standards, so --

MR. HOSLER: It's really a question of this is going to be something that people can comment on later. I mean, it doesn't have to be answered today. But you're proposing that you add this to it to make it more reasonable in the standard, to just make this windows closed.

MR. WILCOX: Right.

MR. HOSLER; So we can comment on it later if we --

MR. MAHONE: Yeah. I was going to point out that under a PG&E project, the Davis Energy Group is collecting data on houses that have night ventilation and what the energy characteristics are, so there will be some data to throw into the mix so we kind of get beyond the, you know, what Bill does in his house kind of argument.

COMMISSIONER ROSENFELD: But, Doug, a serious question. I don't, I'm not claiming that people are irrational, but it seems as if we ought to have some basically just focus group data. That is, what you wouldn't want to do is to assume in certain climate zones that the windows are closed all night when, in fact, 90 percent of the people say they keep their windows open at night. So we just need some sort of mild survey data, I would think.

MR. MAHONE: Right.

MR. PENNINGTON: I think the DEG data is

going to show that the vast majority of people close their windows. And that's --

COMMISSIONER ROSENFELD: I'll settle for that.

MR. PENNINGTON: -- that's, you know -- well, I won't settle for that, you know. I've already told DEG I'm not going to settle for that.

But anyway, you know, there is that kind of data. It's hard to get data on this question.

MR. HOSLER: Right. We used to give, you know, encourage people to put whole house fans in for energy conservation measures, simply because the idea that if you got a big enough temperature change, and they don't work very well unless you leave your windows and doors open, and stuff. So there's a -- I don't know, it's something that I think probably just needs a little more discussion on. Because I think a lot of people in some parts of the state do leave their windows open a lot.

MR. WILCOX: Well, this would actually -- partly what we're trying to do here, Daryl, is this would give you an option for showing that a whole house fan would improve energy conservation, because the whole house fan would allow you to ventilate at night when this rule would say that otherwise you wouldn't.

MR. HOSLER: Right.

MR. WILCOX: So, and I think there's a legitimate trade-off there. I think it's a real significant climate zone issue. I once -- I think it was the '92 standards revision, did a couple of serious walks through Oakland, counting how many houses had windows open and how many didn't. And, you know, in the climate zones where people traditionally don't have air conditioning, people really do leave their windows open a lot, particularly in two story houses, where you don't have security problems and stuff.

But I think in the hot climates where the big impact with cooling is, to assume that those people are leaving their windows open at night is probably very optimistic.

MR. HOSLER: Right, I agree with that. We've done statewide studies for indoor air quality stuff, where, you know, doing air exchange rates you can tell people leave their windows open even in the wintertime in California. So that's kind of the data that I'm looking at. But, yes, if it's 95 degrees out at midnight, they probably

don't have their windows open, they're still
running the air conditioner.

MR. WILCOX: And part of what the
current model does is if it's 95 degrees at
midnight, and then it cools off to 75 by 4:00 in
the morning, we assume they get up and open the
windows and turn the air conditioner off. And
that, in those climate zones, is where the big
impact is.

MR. MAHONE: Daryl, do you have some --
is any of that data available to inform this
discussion?

MR. HOSLER: Well, I want to look at it
and see if it's really worth making a big deal out
of it, first of all. But yes, that data is
available.

MR. MAHONE: It's always better to have
data.

MR. PENNINGTON: Let me ask you a
question, Daryl. Is it possible to disaggregate
from that data the impact on ventilation from
infiltration from the impact on, you know, from
windows?

MR. HOSLER: I haven't looked at it in a
long time. I'm not 100 percent sure if we can do

that.

MR. PENNINGTON: It would seem like that would be quite difficult to do.

MR. HOSLER: Yeah. The part of the analysis was seeing this air exchange rate and try to figure out why that happened. It seemed high. And I think part of interviewing the customers and other people, they found that leaving the windows open was one of the activities that they did. We have a lot of raw data. It's a matter of going back and re-analyzing it. But we can take a look at that.

MR. WILCOX: Okay. Anymore on ventilation?

MR. GATES: Yeah. Bruce, if you revise that model at all I think it would certainly be reasonable enough to at least make the assumption that if it hasn't cooled off enough by, say, 10:00 o'clock or 11:00 o'clock at night, that if the windows are closed then, that they stay closed, you know, because you're right, people aren't going to get up and open them. That's highly unlikely.

And then in terms of, you know, if you have any lower limits on, like if people, you know, sometimes people can get too cold, and they will get up and shut the windows, and so there may be a lower limit on all this that happens without actually kicking on heater, because clearly -- in the summertime, if you can get your house down into the mid-sixties, you know, mid- to low sixties, you're actually pretty happy when you get up in the morning. You don't flip on the heater.

MR. WILCOX: The current assumptions would allow you to have it down all the way to 60, and keep it there. Which I think is too optimistic, as well. I don't think very many people would put up with 60 in their house at night.

Thermostats, another issue in which we have -- can have lots of opinions that don't agree on various things. With thermostats we currently assume constant cooling setpoint of 78 degrees every day, in all houses, and a heating setpoint of 68 set back to 60 at night, in all houses.

There's been -- I've personally done some measurements in new houses in a couple of different studies in which we concluded that it was -- that the cooling really wasn't -- shouldn't have been constant. It's -- people have their --

sometimes have their cooling turned off. John Proctor's done a lot of work that shows that not all the houses have the air conditioning on all the time, and so forth. Heating setbacks in the data I looked at was rarely as low as 60, and we've been discussing this issue for a long time.

So this proposal is that we change the setpoints and doing it in a way that does a couple of things. It makes it, I think, more reasonable as a representative behavior. It also tends to make the TDV calculations get answers that are closer to what people measure as the real energy impact of residential air conditioning and heating systems.

The cooling we propose to set up to 83 from 7:00 a.m. to 1:00 p.m., and then at 1:00 p.m. you start stepping the temperature down gradually to get to 78 over the next five hours. And so this is a change from the 78 constant to say that part of the time during the daytime some of the houses are not -- haven't been running their air conditioners. And some -- Bill likes to talk about the families that come home with their little kids at 3:00 o'clock and turn the air conditioner on, and other people that come home after work at 5:00 o'clock and turn the air conditioner on.

Part of this stepping down the setpoints is intended to represent, you know, the range of behaviors, including the people that are home all the time, and the people who don't come home until in the evening and turn on the air conditioner at that point. And it's, I think it gives a reasonable result.

The heating we're proposing to set back to 65 instead of 68, and that's I think another reasonable conclusion. Again, this is not something that anybody ever sees. If you look at the next page we have a little graph of the heating setpoints -- next slide. Go ahead.

MR. HAMMON: Go ahead with the slides.

MR. WILCOX: Okay. You can see them on the handout probably. We need to have the Energy Commission institute a minimum brightness for slide projectors as part of the standards update.

But the big change here in the heating is the -- I'm not sure the slide layout will have any effect on that. So the big change is at night, when -- the proposal here is we drop it down to 65 instead of formerly down to 60.

The next slide, cooling setpoint. The 2001 and previous values is it's constant at 78, and we're proposing for here to take it up to 83, which is basically a turn off in most climate zones, but it doesn't allow things to get wild. And so then you step down at one degree an hour, which means that you don't get any huge spikes, it's a fairly smooth transition, down to 78 again.

If you turn -- go to the next slide. One of the reasons, one of the things that seems to me argues for this approach is that if you look at the comparison of the cooling watt hours, the cooling consumption, the old assumption of a constant setpoint gave you a pattern that looks like that. This is a peak day in Climate Zone 13, in Fresno. And the new assumption gives you a larger peak later in the afternoon, which according to our understanding really represents better what residential air conditioning load check looks like in the real world. So that's part of the rationale for what's going on here.

MR. HAMMON: Bruce, I've got a question.

MR. WILCOX: Go ahead, Rob.

MR. HAMMON: My concern with all of this, a couple things. One is I'm concerned about changing what we're doing without any data. Commissioner Rosenfeld mentioned that already. And there is some thermostat data and so forth, but it would be nice to understand how we're coming to these suggested changes.

The other thing is that it says on the slide that because it's going to be the same on both sides of the equation there's no impact. I don't agree with that at all.

MR. WILCOX: It doesn't say on the slide no impact.

MR. HAMMON: Okay. That's the impression I got. I think that each one of these things is going to have an impact, because it's going to change differentially the heating and cooling energy predicted by the program, the budgets. And I would hope that we'll have a chance to look at each one of these independently, and the impact that they have on the standards themselves, before we make any jumps to adopting.

MR. WILCOX: Well, look, I can leap to my conclusion here and tell you that our assessment is that the overall heating and cooling energy statewide, with this package of changes, remains almost exactly the same as it was in the

2001 standards and their -- in its modeling rules. And that's -- so, again, this is a whole combination of things all of which interact with each other. It's hard to look at them individually one at a time, because one thing does this and the other thing does that, and they balance. And we actually went after a balance to try and maintain the --

MR. HAMMON: Let me restate. In past revisions of the standards something that has happened is we go through and we do all sorts of analyses on what features we're going to change and how much, and so forth. And then at the very end, there are changes internal in the algorithmic changes that, whoa, change --

MR. PENNINGTON: We're trying to flip that on its ear.

MR. HAMMON: Right.

MR. PENNINGTON: That's why we're talking about these right now.

MR. WILCOX: Yeah, right. We're trying to do that first this time.

MR. HAMMON: Great.

MR. WILCOX: So we'd like to actually not leave these things all wide open until the end, in which case -- that would be the case.

MR. HAMMON: Thanks.

COMMISSIONER ROSENFELD: Let -- Bruce, just a second. All these thermostat changes that you make, are certainly gains. But if you had some data showing that this theoretical air conditioner curve sort of matches some utilities' experience, and the same for the heating, it would be more persuasive.

MR. WILCOX: Okay.

COMMISSIONER ROSENFELD: I agree it's plausible, but that's not quite the same as saying wow, it fits pretty well.

MR. WILCOX: But it's -- yeah, they're -- actually we don't -- well. Yeah, there's some issues involved in how you actually argue that. But we do have some data that, I think, that shows that curve is in the right ballpark, and we can present that. I don't have it here today.

All right. Then the next thing on the list here is the glazing obstruction factor. This is a factor that we've used for a long time to adjust the calculated window solar heat gain. It physically represents things like shading from surrounding houses and trees, and the fact that the computer models assume the house is sitting out in the middle of an open unobstructed field, with a uniform ground reflectivity, and that really isn't the cast for real houses. Windows get dirty, and all that sort of thing. And the models are oversimplified in how they deal with glazing solar gain.

The current factor that we've been using since '92, I believe, is .67, which is reducing the solar gain by a third. And the proposal here is to change that to 0.72 -- it says .75 on your printout, but it should be .72. That was actually an error in the thing that I passed out.

So, and then the final slide here -- go to the next one -- has to do with the envelope leakage. The -- the assumption in an envelope leakage has been a specific leakage area ratio of 4.9.

MR. ELEY: Did you explain why you're changing the glazing obstruction thing?

MR. WILCOX: It's -- it has to do with in the end, the balancing -- well, I think there's a general feeling that that number is pretty low. And so the, in the end, we changed it to balance out the heating and cooling to be the same as it was in 2001, given all the other changes. So this really is a package of changes.

MR. ELEY: So this was sort of the calibration.

MR. WILCOX: Yeah, that's really the calibration factor involved there. Because there's no real good way to measure that number.

So, anyway, the glazing envelope leakage, SLA of 4.9 was based on data that -- primarily on data that I measured in 1988, on 1988 new production houses. There's quite a bit of evidence that houses built in the late 1990's and 2000 are significantly tighter, just because of construction practice changes that have happened since then. LBL has a bunch of data that indicates that houses are tighter. I've measured data that was -- in '95, that had houses somewhat tighter.

So the proposal here is to change the default assumption for envelope leakage from 4.9 down to 4.5, which is about a ten percent reduction in envelope leakage area. This actually has a theoretical impact on people who wanted to build very tight houses, and we've lowered our testing. This would reduce the amount of credit that was available for doing that. As far as I know that's not a major area of activity amongst California builders at this point, so I don't think it's a big issue. But we think this, again, will help get the overall assumptions closer to reality in their houses.

COMMISSIONER ROSENFELD: What are the units in this 4.7?

MR. WILCOX: Specific leakage area, which is the ratio of the envelope leakage area to the floor area of the house. This was in vogue at LBL about 1989, and then a year later they decided that normalized leakage was better and changed after we put SLA in the standards. But it's convertible to between SLA and normalized leakage straight across.

COMMISSIONER ROSENFELD: Okay.

MR. RAYMER: But you've got what you feel is good data to show that in the late 1990's, that homes indeed are tighter?

MR. WILCOX: Well, I think it's -- I'm not sure how good the argument is, but I think it's probably -- and we don't have any data to show that they're as loose. We have a fair amount of data, Rob's measured a bunch of data that shows the houses are relatively tighter. I've measured a bunch of data that shows houses are relatively tighter. No one has gone after a representative sample of new houses to prove that the SLA has changed.

MR. DeLAURA: I have just a quick request. This is Lance from SoCalGas. Could we get a copy of any information you have on this?

MR. WILCOX: Sure. Maybe Art could get to help us convince the Lawrence Berkeley Lab guys that they could do this, because --

MR. HAMMON: Question, Bruce. I think there are -- well, I know there are a lot of Energy Star homes in California that take advantage of that credit. And I'm wondering -- there is going to be an impact on those trying to build above code by doing this. And I'm wondering, other than there is some data, I agree with you, there is some data that shows the homes are tighter. But in all the previous issues you've had a reason to want to do this. What's the reason in this case?

MR. WILCOX: Well, you know, Bill wanted to change it to 3.5, and we compromised on four.

(Laughter.)

MR. PENNINGTON: I think that data is pretty clear that it's less than 4.9 SLA, on average now. The question comes down is that really every vanilla house out there representatively sampled, but all of the datasets that I've seen, the SLAs don't approach 4.9, on average.

MR. HAMMON: I agree. I mean, the BIA data is -- and I'm sure you're talking partially from that data -- that data is coming from builders who care about having inspections done, having training done, and I think it's pretty selective in a very real way. We have measured homes that are well beyond, much less airtight than 4.9, and I'm just -- the impact that I see here is that you're diminishing the credit for those who do want to build tighter. And I don't see an advantage in the standards to making this correction. And I do see a disadvantage.

So I'm just, I'm wondering whether this is something to re-think, for that reason. I don't disagree with you about the data that we have, and I don't -- I don't know how representative it is, either.

MR. WILCOX: Well, I think the -- I feel

pretty comfortable with this, because I think it's a modest change. And it's, I think there's little doubt that there has been some change, and this represents some change. The data we did in 1988, the 4.9 data, I think was pretty solidly in all houses. And the data we did in '92, where we didn't focus as much on leakage area, that was pretty representative data and that showed much tighter houses for the Central Valley.

MR. HAMMON: I guess what I'm thinking is, you know, people learn to do certain things, and like maybe they tend to build with more efficient envelopes, better windows, whatever, costs come down, and you tend to take advantage of those increases in construction features and quality in the standards. And generally, what you're doing is moving the standards up as the market improves.

In this case, I don't see an advantage in that, because we're not going to be measuring anything. And so you're not confirming that you're getting this increase in energy efficiency. All you're doing is taking away the credit that somebody gets for actually taking the extra steps to build more tightly. And I'm just, I mean, I haven't thought about this other than for the two minutes that -- or ten minutes that it's been up there. But I'm not sure that this is the right move in terms of grabbing improvement in construction quality and getting something back for it. I think it may have a negative impact.

MR. WILCOX: Okay. Any other questions or comments? If not, that's the proposed package of residential computer modeling changes.

MR. ALCORN: Thank you, Bruce.

I know we're, on our agenda, we're set to adjourn, and we're a little bit, about ten minutes late. But we do have one more presenter, Mark Lindberg, from FAFCO, to talk about Thermal Energy Storage tests, and this will be about a five or a ten minute presentation.

MR. MAHONE: Is that on the computer right now?

MR. ALCORN: Actually, I don't know. If you haven't given it to them, it --

MR. MAHONE: Can I just ask a question about Bruce's presentation before we change the subject? So what's the outcome of Bruce's package of measures? I mean, are we --

MR. ALCORN: Resounding support is what

I heard.

MR. MAHONE: -- supposed to use these, are they supposed to be implemented in Micropas, or what, I mean, what happens?

MR. WILCOX: Who gets to decide, I guess is --

MR. PENNINGTON: Yeah, that would be the next step, is to --

MR. MAEDA: We've been presented with about 25 different versions of all these things, and several thousand theories of --

MR. ELEY: Well, I think one thing is a lot of the -- a lot of the residential analysis that depends on these modeling assumptions has been held up, and will be, it has been put off to the second phase of their work. So some of these things will be considered in May instead of later this month. I mean, an example, I guess, is the ducts, you know.

MR. MAHONE: Well, yeah. That's the reason I'm asking. I've got a bunch of different teams working on residential code change proposals, and should they be using these now, or --

MR. PENNINGTON: Yes.

MR. MAHONE: Yes.

MR. PENNINGTON: That would be preferable. I'm not sure which ones you're talking about, actually. Maybe we can have a side conversation about this. If a substantial amount of work has already happened using an earlier versions, then maybe we ought to talk about the damage that does to the schedule in that project. I thought there weren't that -- really that many projects that were using Micropas to evaluate things. I think there's just a couple, actually.

MR. MAHONE: Yeah, I'd have to think about that.

MR. HAMMON: Bill, if we can take that discussion a little broader. We were talking to Ken, and your side comment is -- okay. We were talking to Ken a little bit earlier. We, CBI has been looking forward to getting a version of Micropas that we can use to try and evaluate the impact of some of these things. And we were looking at next week, but next week doesn't have these things in it.

And what's more, I'd like to thank Lance, the gas company, Tony, Edison, and Gary, PG&E, for supporting his ability to get a test version of Micropas for us to do this. But it would really be helpful to be able to at least, as a package, maybe the right way is as a package, Bruce, to have these things either turned on or turned off so we can see what is the impact of these things, because I do not think they're going to be neutral. But I'm looking forward to being surprised.

MR. WILCOX: I don't know. The stuff is available in Micropas. We've tested it all. It is neutral. That's how we came up with the exact numbers, so --

MR. HAMMON: But you tested it on what homes?

MR. WILCOX: Well, this has all been tested on the prototypes.

MR. HAMMON: On the --

MR. WILCOX: On the 1761 prototypes.

MR. HAMMON: Yeah. And we never the same results with the real homes as we do --

MR. WILCOX: Well, we don't expect to get the same results, but that's the basis here. And if you get a version of Micropas, this will be available for sure.

MR. ALCORN: Okay. Ahmed.

MR. AHMED: I recall our office saying we would like to be able to do some simulations and do some sensitivity analysis, but we are not able to get the model.

MR. FERNSTROM: Well, let me speak to that. As Rob noted, Edison and PG&E are working on helping Ken to get at least the TDV methodology available in Micropas. So every time a run is done, it'll come up with both TDV and traditional source energy results. I'm not sure about all these other opportunities that Bruce has pointed out.

MR. NITTLER: I guess it's my turn. Every one of the features that Bruce was describing as a package are actually things that have been in Micropas forever. It's just doing things like changing the thermostat schedules, things you don't normally do for compliance. So I'll look at Rob's comment, which is switching the whole thing on and off, kind of with a yes/no, and it would do all four or five things. That's doable.

But the whole idea would be, or at least for us working on it, our problem is we can't go forward and look at things like glazing percentages and buildable packages and all this stuff, for all the reasons you guys know. We need to know what the answer is before we do all that work. So we'll be able to accommodate you, I think is what's happening here.

MR. AHMED: But for our analysis, basically, all the presentations that were today done by Doug and Bruce and Charles, and Doug, again, all the measures like the houses, heat pumps, and the thermostats, and ventilation and the slab edge, all the measures that were discussed today, if there is a model available to analyze it, we would like to get hold of it. That's our concern. And there isn't much time.

MR. ALCORN: Okay. Are there anymore comments, questions?

Okay. Mark.

MR. LINDBERG: Thank you very much. I'd like to thank everybody for staying an extra -- I'll keep it to seven minutes, my presentation, and I'll let Bryan decide how many questions I get.

As I -- and also, I want to compliment the Energy Commission on really, what I consider really, some really forward thinking. As I was listening to this, and we were talking about well, let's see, flat rates are not necessarily appropriate. I mean, we're going to perhaps create some alternatives for that. And we talked about cooling being favored for TDVs, and then we talked about electricity, and I just kept thinking well, thermal energy is, you know, squared and cubed, so here we go.

So if I could look at the next slide. I want to make sure, even though I work for FAFCO, I'm representing all the manufacturers here in the industry.

Next slide, please. We are all familiar with this problem. We've talked --

MR. PENNINGTON: Are you representing ARI at this -- in these comments?

MR. LINDBERG: I'm not representing ARI directly, but we got permission from ARI to use this information, and we, as a matter of fact, this was a slide presentation that was developed for the Energy Commission probably over a year ago, and the opportunity I think is really appropriate right now for this.

This is something we're all familiar with. This is why we're doing this. Next slide, please.

What is thermal energy? A very simple definition. There's a handout of this presentation in the lobby. But we address really all these items. We probably address peak demand more significantly, and energy usage more significant -- energy costs more significantly, and some of the other things are dependent on the situation.

Next slide, please. The chiller is -- clearly can be 40 percent of peak demand in a commercial building, a typical commercial building where you have about 500 square feet per ton, with the normal lighting loads and the typical plug loads.

Next slide, please. We've talked a little bit about cost today. We haven't defined it, but there are scenarios where I think if you are on hydro at night, and compared to a peaking plant in the day, I think you could -- a lot of people here would agree with me that daytime energy costs could be four to five times higher. And once again, demand is lowered 40 percent by shifting load off peak.

Next slide, please. We're all familiar

with this. This is a typical load profile for a commercial building. A big portion is the cooling, and basically what we're going to do is we're going to shift, in what we call a partial storage situation, we're going to shift this cooling load to both sides of the peak by building ice banks at night.

Next slide, please. So we shift 500 kW right during the peak that we're talking about, and we've shifted it off peak by building ice at night, running the chiller at night in that ice building mode, and that directly impacts what we're talking about because when we look at some of these curves there's plenty of energy available at night in California, even in the peak season, August, September.

Next slide, please. These -- I don't advertise thermal energy storage as an energy saving device. I can make examples with, you know, different types of cooling towers, different types of chillers, different situations, different climate zones, where we could probably actually save energy. But let's remember we're operating a chiller a little less efficiently at night because it's operating at a lower suction temperature.

However, the condensing temperature is also going to be lower. So it's not a complete trade-off. And when we get into the modeling, I think we're going to be pleasantly surprised at some of the advantages of thermal storage, really, in terms of especially peak load shift, but when we get into the costs and TDVs operating at night.

Next slide, please. Okay. That was two, but that's all right. I think we covered that one before.

So basically there's a CEC reference here to the source energy. And there's a building in Texas, the Centex Building, where we documented the site energy reduction.

So, yes, sir.

COMMISSIONER ROSENFELD: Oh, I was just waving to somebody behind you.

MR. LINDBERG: Oh, okay. I thought maybe -- so, anyway, there are lots of installations worldwide. I think all of us have seen the cycles of TES over the years.

Next slide, please. There's been a -- we've got a real history here. We've got lots of installations worldwide, in California. Let's try one more bullet. There you go. One of the things that's happened with thermal energy storage, not to anybody's particular fault, but there were ups and downs in rebates. Real time pricing came in, time of use pricing came in, and I think we always had kind of a little bit too much of a moving target, and some of the systems weren't always used so much maybe the way they were intended, maybe the way they could've ultimately been used. I think some people maybe put them in to get the rebates, and the systems weren't necessarily operated properly.

However, we've got lots and lots of systems that are shifting load every single day in this state from peak to off peak, and in the country, in general. And the manufacturers that were on in the beginning of this have all been in business a long time, with great track records.

So I really appreciate, again, the opportunity to speak here, and I think we're going to hear a lot more in the future about it. We're going to become -- we're going to be in this model some -- one way or another, because we can model chillers on part load, we can model pumps, the whole system can be modeled very accurately for total energy, for demand shift. And with what we've been talking about, with TDVs, I think it'll come out very favorably.

Thank you very much.

MR. ALCORN: Thank you, Mark. Are there any questions or comments for Mark?

COMMISSIONER ROSENFELD: Yeah. I guess I have a question. I am, and I guess everybody in this room is an advocate of thermal storage. What's going on right now is, of course, great for you, because for the first time off peak electricity will be modeled, on peak electricity will be modeled high, and off peak electricity will be modeled low.

So really, the only question I have is to the professional modelers for commercial buildings. Do you guys take care of thermal storage pretty well in the existing compliance modeling?

MR. PENNINGTON: No.

COMMISSIONER ROSENFELD: Is he really off the hook or not?

MR. PENNINGTON: No. The current modeling of thermal energy storage, first off, it doesn't get any credit. Basically, the energy necessary to charge the storage medium is forgiven in the current standard. But otherwise, it's sort of neutral, the current standard is neutral.

COMMISSIONER ROSENFELD: The current standard. But now, as we move into TDV --

MR. PENNINGTON: Right. As we move into this, there will need to be the development of modeling rules for how to appropriately model thermal energy storage systems so they reliably achieve what the potential appears to be. And that's a compliance option that the, you know, the advocates for thermal energy storage need to sponsor, to get that --

COMMISSIONER ROSENFELD: That's what I'm trying to find out.

MR. LINDBERG: We're working on that.

COMMISSIONER ROSENFELD: So there's some sort of collaboration under way.

MR. LINDBERG: Yes.

MR. ALCORN: Bruce Maeda.

MR. MAEDA: I want to -- Bill, you misstated a little bit. The charging system and the discharging, that uses actually counted, but it's constant use. It's the energy used to maintain the state of the system, like you say, cold temperatures, for example, or momentum if it's an intertial system, or something along that line, to maintain the state is forgiven and exempt. But the energy use, whenever it occurs, it occurs, and is counted, and so it would be the same for a thermal energy system as for a conventional system under the current standards. It would not be penalized, but it also has no benefit. And we prevent it from being penalized by keeping the maintenance of the state of the system to be exempt, and that energy is exempt.

MR. ALCORN: Thank you. Are there anymore comments or questions? Steve.

MR. GATES: Just in terms of modeling capabilities of the existing compliance tools. To give you a little background, the thermal storage algorithms in DOE 2 were written by a grad student -- in fact, that was me -- over 20 years ago, in the period of about a week, a week and a half, when I was a grad student at Lawrence Berkeley Lab.

MR. LINDBERG: Boy, were you efficient.

MR. GATES: Well, the sophistication of the algorithms reflects the time that was spent on them, is the basic comment.

And in particular, if the Commission and other parties are interested in pursuing thermal storage in more detail, and having that included as, you know, in more detail in the ACM, then the algorithms also need attention.

MR. LINDBERG: I agree, and we'll be talking to you.

MR. ALCORN: Okay. Thanks, Mark.

Are there anymore questions or comments over the -- general questions or comments for over the course of the day, that somebody wants to bring up before we adjourn?

MR. HAMMON: I have a question. It's not today, but I have your e-mail, and -- it says, the next workshop is the 22nd for performance verification contractor report. What's that?

MR. ALCORN: That's the report that NBI, Jeff Johnson is working on. It's another, even though it's one of the measures that we're looking at, it's not actually one of the ones that the Commission is funding.

MR. ELEY: It's non-residential.

MR. ALCORN: It's a non-residential performance verification for HVAC.

MR. HAMMON: Okay. Thanks.

MR. ALCORN: Okay. I also, on that

subject, I wanted to mention that the next workshop is April 22nd, for performance, non-res performance verification. There's also one the very next day, April 23rd, which will be discussing some of the remainder of the contractor reports, primarily the one that Charles Eley's subs are going to be delivering, presenting on that day. So put that on your calendars, so you can be here.

And we have another date in May, it's May 30th, and the agenda for that workshop, at least at this early date, is to go over the remainder of the contractor reports that we are unable to address in the April 23rd workshop. So that's another date to put on your calendars.

MR. MATTINSON: I know this is difficult for the contractors, but at some point your presentations and your papers go to print, and I'm wondering if it would be possible to send them out in an e-mail so that the night before, or the morning before, we could look at some of this material, because it sounds like you guys are expecting to act upon what happened today without those of us in the audience who only saw it for the first time today to be given much time to reflect upon it.

MR. PENNINGTON: Two of the reports were -- have been on the Web site for about two weeks. Both the TDV report and the Life Cycle Cost Methodology report. We also did a sort of status report that's been on the Web site for about ten days, that lists the items.

So that was our attempt to get the information out early.

MR. MATTINSON: Well, that's appreciated. Thank you.

MR. ELEY: The -- our goal is to post documents on April 9th, for the April 23rd workshop. That's -- and we may be a day or two off of that, but that's still our goal.

MR. MATTINSON: And maybe you'll notify the e-mail list when they go up?

MR. ALCORN: Yes, most definitely, Bill. And we'll try to do the same thing for the May 30th workshop, two weeks before.

Okay. Any other comments, Bill?

MR. PENNINGTON: No.

MR. ALCORN: Okay. Thank you all very much. Great comments and questions today, and presentations, as well. So thanks very much for your participation.

We're adjourned.

(Thereupon, the workshop was concluded at 3:55 p.m.)

CERTIFICATE OF REPORTER

I, PETER PETTY, an Electronic Reporter, do hereby certify that I am a disinterested person herein; that I recorded the foregoing California Energy Commission Staff Workshop; that it was thereafter transcribed into typewriting.

I further certify that I am not of counsel or attorney to said Workshop, nor in any way interested in the outcome of said Workshop.

IN WITNESS WHEREOF, I have hereunto set my hand this 8th day of April, 2002.